ABSTRACTS

Janusz Gołdasz, Bogdan Sapiński
Application of CFD to Modeling of Squeeze Mode Magnetorheological Dampers

The so-called squeeze flow involves a magnetorheological (MR) fluid sandwiched between two planar surfaces setting up a flow channel. The height of the channel varies according to a prescribed displacement or force profile. When exposed to a magnetic field of sufficient strength MR fluids develop a yield stress. In squeeze-mode devices the yield stress varies with both the magnetic field magnitude and the channel height. In this paper an unsteady flow model of an MR fluid in squeeze mode is proposed. The model is developed in Ansys Fluent R16. The MR material flow model is based on the apparent viscosity approach. In order to investigate the material's behaviour the authors prepared a model of an idealized squeeze-mode damper in which the fluid flow is enforced by varying the height of the channel. Using mesh animation, the model plate is excited, and as the mesh moves, the fluid is squeezed out of the gap. In the simulations the model is subjected to a range of displacement inputs of frequencies from 10 to 20 Hz, and local yield stress levels up to 30 kPa. The results are presented in the form of time histories of the normal force on the squeezing plate and loops of force vs. displacement (velocity).

Artur Ganczarski, Damian Szubartowski
On the Stress Free Deformation of linear FGM interface under Constant Temperature

This paper demonstrates the stress free thermo-elastic problem of the FGM thick plate. Existence of such a purely thermal deformation is proved in two ways. First proof is based on application of the Iljushin thermo-elastic potential to displacement type sys-tem of equations. This reduces 3D problem to the plane stress state problem. Next it is shown that the unique solution fulfils conditions of simultaneous constant temperature and linear gradation of thermal expansion coefficient. Second proof is based directly on stress type system of equations which straightforwardly reduces to compatibility equations for purely thermal deformation. This occurs if only stress field is homogeneous in domain and at boundary. Finally an example of application to an engineering problem is presented.

Vasyl' Shvabjuk, Georgij Sulym, Olena Mikulich
Stress State of Plates with Incisions under the Action of Oscillating Concentrated Forces

This paper proposes the novel technique for analysis of dynamic stress state of multi-connected infinite plates under the action of oscillating forces. Calculation of dynamic stresses at the incisions of plates is held using the boundary-integral equation method and the theory of complex variable functions. The numerical implementation of the developed algorithmis based on the method of mechanical quadratures and collocation technique. The algorithm is effective in the analysis of the stress state caused by steady-state vibrations of plates.

Zbigniew Budniak
Modelling and Numerical Analysis Of Assembly System

The present articles covers a concept of the creation and testing of assembly systems with the use of modern CAD and CAE systems on the example of an assembly system designed for joining parts with circular surfaces that are fitted with positive clearance. The numerical investigations were based on the constructed spatial skeleton pattern of the system. The purpose of the simulation tests was to determine the impact of the measurement and angular inaccuracies of all the elements of the assembly system as well as the inaccuracy of the positioning of the robot's drives on the positioning accuracy of the parts joined taking into consideration the conditions of assembly in automatic assembly.

Monika Prucnal-Wiesztort
Accuracy of Positioning and Orientation of Effector of Planar Parallel Manipulator 3RRR

Parallel manipulator belongs to group of mechanisms with closed kinematic chains. This feature involves both advantages and disadvantages. The study examined the issue of accuracy of a planar system with three degrees of freedom, with revolute pairs, showing the effect of errors of the drives settings on effector positioning deviation. Enclosed is a numerical example for which analyzed the deviation in motion manipulator when going through the singular configuration. Based on the analysis was determined the area around the singular positions for which to obtain the orientation of the assumed accuracy is impossible.

Krzysztof Kęcik
Application of Shape Memory Alloy in Harvesto-Absorber System

This paper presents a conception of the harvester-absorber system consisting of two parts. The first is the pendulum attached to the main system (oscillator), which is suspended on the linear damper and the nonlinear spring made of shape memory alloy. The spring is modelled as a polynomial function based on Landau–Ginzburg theory of phase transitions (similar as ferroelectric and ferromagnets). The obtained results show, that SMA element can increase harvesting energy level, while the absorber effect can be impaired (but not loss). Additionally, introducing SMA element causes changes in dynamics, introduces a new unstable solutions and bifurcations. The analysis was done by classical integration and continuation solution methods.

Aneta Bohojło-Wiśniewska
Numerical Modelling of Humid Air Flow around a Porous Body

This paper presents an example of humid air flow around a single head of Chinese cabbage under conditions of complex heat transfer. This kind of numerical simulation allows us to create a heat and humidity transfer model between the Chinese cabbage and the flowing humid air. The calculations utilize the heat transfer model in porous medium, which includes the temperature difference between the solid (vegetable tissue) and fluid (air) phases of the porous medium. Modelling and calculations were performed in ANSYS Fluent 14.5 software.

Dominik Sawicki, Eugeniusz Zieniuk
Parametric Integral Equations Systems Method in Solving Unsteady Heat Transfer Problems for Laser Heated Materials

One of the most popular applications of high power lasers is heating of the surface layer of a material, in order to change its properties. Numerical methods allow an easy and fast way to simulate the heating process inside of the material. The most popular numerical methods FEM and BEM, used to simulate this kind of processes have one fundamental defect, which is the necessity of discretization of the boundary or the domain. An alternative to avoid the mentioned problem are parametric integral equations systems (PIES), which do not require classical discretization of the boundary and the domain while being numerically solved. PIES method was previously used with success to solve steady-state problems, as well as transient heat transfer problems. The purpose of this paper is to test the efficacy of the PIES method with time discretization in solving problem of laser heating of a material, with different pulse shape approximation functions.

Piotr Czarnocki, Kamila Czajkowska
Delamination Resistance of Laminate Made with VBO MTM46/HTS Prepreg

A laminate made with the Vacuum Bag Only (VBO) prepregs can be cured out of autoclave. Because of low curing pressure such a process can result in deterioration of laminate mechanical properties. They can be significantly lower than those displayed by the autoclave cured ones. The resistance against delamination can be among the most affected. Since this property is a week point of all the laminates it was of particular interest. Delamination resistance of unidirectional laminate made from VBO MTM46/HTS(12K) prepreg was in the scope of the presented research and the critical values of the Strain Energy Release Rates and the Paris-type equations corresponding to Mode I, Mode II and Mixed-Mode I/II static and cyclic loadings, respectively, were determined.

Heorhiy Sulym, Lyubov Piskozub, Yosyf Piskozub, Yaroslav Pasternak
Antiplane Deformation of a Bimaterial Containing an Interfacial Crack with the Account of Friction. 2. Repeating and Cyclic Loading

The paper presents the exact solution of the antiplane problem for an inhomogeneous bimaterial with the interface crack exposed to the normal load and cyclic loading by a concentrated force in the longitudinal direction. Using discontinuity function method the problem is reduced to the solution of singular integral equations for the displacement and stress discontinuities at the domains with sliding friction. The paper provides the analysis of the effect of friction and loading parameters on the size of these zones. Hysteretic behaviour of the stress and displacement discontinuities in these domains is observed.