ABSTRACTS

Aneta Bohojło
Numerical Analysis of Thermal Comfort Parameters in Living Quarters

This paper includes an evaluation of ventilation conditions in a given living quarters – a room in a single-family house, based on local parameters of thermal comfort determined by numerical calculations. Global parameters (Predicted Mean Vote and Predicted Percentage of Dissatisfied) and local parameters (including: Resultant Temperature, Relative Humidity) were determined from numerical solution of transient case of living quarters ventilation in ANSYS-CFX software.

Viktor Bozhydarnyk, Iaroslav Pasternak, Heorhiy Sulym, Nazar Oliyarnyk
BEM Approach for the Antiplane Shear of Anisotropic Solids Containing Thin Inhomogeneities

This paper considers a development of the boundary element approach for studying of the antiplane shear of elastic anisotropic solids containing cracks and thin inclusions. For modeling of thin defects the coupling principle for continua of different dimension is utilized, and the problem is decomposed onto two separate problems. The first is an external one, which considers solid containing lines of displacement and stress discontinuities and is solved using boundary element approach. The second is internal one, which considers deformation of a thin inhomogeneity under the applied load. Compatible solution of external and internal problems gives the solution of the target one. Stroh formalism is utilized to account the anisotropy of a solid and inclusion. Numerical example shows the efficiency and advantages of the proposed approach.

Mikołaj Busłowicz
Stability of The Second Fornasini-Marchesini Type Model of Continuous-Discrete Linear Systems

The problem of asymptotic stability of continuous-discrete linear systems is considered. Simple necessary conditions and two computer methods for investigation of asymptotic stability of the second Fornasini-Marchesini type model are given. The first method requires computation of the eigenvalue-loci of complex matrices, the second method requires computation of determinants of some matrices. Effectiveness of the methods is demonstrated on numerical example.

Maciej Ciężkowski
Stabilization of Pendulum in Various Inclinations Using Open-Loop Control

The paper presents the stabilization method of physical pendulum in various inclinations. The theory of the motion in a rapidly oscillating field has been applied to explain the phenomenon of stabilization and to set conditions for the stability of the pendulum. The paper shows results of computer simulations which confirm that the position control of the pendulum in the open-loop is possible.

Janusz Gołdasz, Bogdan Sapiński
Modeling of Magnetorheological Mounts in Various Operation Modes

Recent advances in the research of magnetorheological/electrorheological (MR/ER) fluid based devices have indicated the opportunities for smart fluid based devices utilizing more than one operation mode. As such, the purpose of the present research is to draw attention to the existing models of magnetorheological (MR) mounts operating in two of the three fundamental operating modes, namely, the flow mode and the squeeze mode, and to highlight the potential applications of these modes in hydraulic mount applications. Therefore, in the paper the authors focus on recent applications of MR/ER fluids in that domain, and then proceed to summarizing the modeling principles for the two operation modes followed by a finite-element magnetostatic analysis of the mount's magnetic circuit, parameter sensitivity study and exemplary numerical simulations of each mode. The simulation results are converted into the frequency domain and presented in the form of dynamic stiffness and damping vs. frequency plots, respectively.

Irina Goryacheva, Yulia Makhovskaya
Modelling of Adhesion Effect in Friction of Viscoelastic Materials

A model is suggested for the analysis of the combined effect of viscoelastic properties of bodies and adhesive interaction between their surfaces in sliding. The model is based on the solution of the contact problem for a 3D wavy surface sliding on the boundary of a viscoelastic foundation taking into account the molecular attraction in the gap between the bodies. The influence of adhesion on the contact stress distribution, real contact area and hysteretic friction force is analyzed.

Piotr Grześ
Influence of Thermosensitivity of Materials on the Temperature of a PAD/DISC System

A heat generation problem due to friction in a pad/disc brake system is studied. A linear problem is confronted and compared with a non-linear in which thermophysical properties of materials are temperature-dependent. To examine temperature of the pad and the disc during a single and a twofold braking process, axisymmetric FE contact model was used. The obtained results revel insignificant temperature differences at specified axial and radial positions of the components of the friction pair. It was remarked that the level of discrepancies between the constant and the thermosensitive materials correspond with the coefficient of thermal effusivity.

Marek Jałbrzykowski, Joanna Mystkowska, Dariusz Urban, Ewa Kulesza, Edyta Andrysewicz
Aspects of Exploitation Stability of Selected Dental Prosthetic Bridges

The paper presents results of microscopic observations of selected porcelain bridges prepared on metallic base. The aim of microscopic observations was the identification of example wear types which have appeared during dental prosthetic bridges exploitation. The main attention was directed to wear forms that are quite often present in case of such prosthetic elements. The wear types comparative analysis was evaluated. The most frequent types of wear are: material's cracking, abrasive wear. Also, the metal corrosion and wear by dental plaque at prosthetic bridge surface were observed.

Agnieszka Jurkiewicz, Yuriy Pyr'yev
Compression of Two Rollers in Sheet-Fed Offset Printing Machine

The most important units of sheet-fed offset printing machine, like the ink and dampening systems as well as a printing unit, are composed, in the main, of contacting rollers of various sizes (in case of the printing unit they are named cylinders). Adequate setting of the said rollers is very important, because it has big influence on quality of print-outs. The settings are made experimentally by measuring the width of the contact area in the ink and dampening systems or by computing the clamp parameters – in the printing unit. This paper includes analysis of compression of two rollers depending on a width of the contact area, radiuses of the rollers as well as their Poisson's ratios and Young's modules.

Tadeusz Kaczorek
Reduction and Decomposition of Singular Fractional Discrete-Time Linear Systems

Reduction of singular fractional systems to standard fractional systems and decomposition of singular fractional discrete-time linear systems into dynamic and static parts are addressed. It is shown that if the pencil of singular fractional linear discrete-time system is regular then the singular system can be reduced to standard one and it can be decomposed into dynamic and static parts The proposed procedures are based on modified version of the shuffle algorithm and illustrated by numerical examples.

Janusz Krentowski, Rościsław Tribiłło
Numerical Analysis of Crosswise Heterogeneous Covering Structures in 3D Class Structure Conditions

The following paper presents the results of analyses of multi-layered elements and thick constructions, as well as simplifications used for solving structures of 2D class models published in specialist literature, and compares them with a different approach involving generalization of pertinent problems into 3D classes. An error estimation method was proposed, together with a procedure of shaping grid's density ensuring necessary computing precision. Solving huge sets of equations allowed for practically continuous values of complex functions of stress states. Several of the presented typical examples indicate the possibility of applying the algorithms, among others, to heterogeneous structures of reinforced concrete constructions.

Michał Kuciej
Generation of Frictional Heat During Uniform Sliding of Two Plane-Parallel Strips

The thermal problem of friction for a tribosystem consisting of two plane-parallel strips is studied. It is assumed that the relative sliding speed is constant. The convective cooling on free surfaces of strips and the heat transfer through a contact surface are considered, too. The evolution of the contact temperature and its spatial distribution in materials of frictional pair such as aluminum/steel, was investigated.

Nataliya Malanchuk, Andrzej Kaczyński
Stick-Slip Contact Problem of Two Half Planes with a Local Recess

A plane problem of frictional contact interaction between two elastic isotropic half planes one of which possesses a single shallow recess (depression) is examined in the case of successive application of remote constant normal and shear forces. The loads steps (compression, and next monotonically increasing shear loads) lead to the main contact problem with an unknown stick-slip boundary determined by the Amonton-Coulomb law. It is reduced to a Cauchy-type singular integral equation for the tangential displacement jump in the unknown sliding region. Its size is derived from an additional condition of finiteness of shear stresses at the edges of the slip zone. Considerations are carried out for some general shape of the recess. Analytical results with the characterization of the considered contact are given and illustrated for the certain form of the initial recess.

Krzysztof Nowak
Grain Size Dependence of Creep Lifetime Modeled by Means of Cellular Automata

Grain size dependence of creep is a complex relation. It can be increasing, decreasing or constant function accordingly to current conditions and material. It is a consequence of complex nature of microscopic mechanisms affecting creep. Some of them are analyzed in current paper by means of multiscale model, using simulation of damage development done by cellular automata technique. It was shown that enlarged sizes of grains, which promote development of intergranular microcracks, are compensated by reduced density of voids forming vacancies. Obtained in simulations grain size dependency follows experimentally observed dependency for small grains in dislocation creep range.

Bogdan Rogowski
Exact Solution of a Dielectric Crack of Mode III in Magneto-Electro-Elastic Half-Space

This paper investigated the fracture behaviour of a piezo-electro-magneto-elastic material subjected to electro-magneto-mechanical loads. The PEMO-elastic medium contains a straight-line crack which is parallel to its poling direction and loaded surface of the half-space. Fourier transform technique is used to reduce the problem to the solution of one Fredholm integral equation. This equation is solved exactly. The semi-permeable crack-face magneto-electric boundary conditions are utilized. Field intensity factors of stress, electric displacement, magnetic induction, crack displacement, electric and magnetic potentials, and the energy release rate are determined. The electric displacement and magnetic induction of crack interior are discussed. Strong coupling between stress and electric and magnetic field near the crack tips has been found.

Vasyl Shvabyuk, Iaroslav Pasternak, Heorhiy Sulym
Bending of Orthotropic Plate Containing a Crack Parallel to the Median Plane

This paper considers cylindrical bending of the plate containing a crack parallel to plate's faces. The analytical model of the problem is obtained using the improved theory of plates bending, which considers transverse deformation of the plate. Received analytical results are compared with the numerical data of the boundary element approach, which is modified to suit the considered contact problem. The results of analytical and numerical techniques are in a good agreement both for the isotropic and anisotropic plates.

Paweł Skalski
Testing of a Composite Blade

The research presented in this paper focuses on the investigation of helicopter composite blade. The object of tests is a blade from main rotor of the IS-2 helicopter. The author describes briefly basic elements of composite blade manufactured at the Institute of Aviation in Warsaw. The composite blade was investigated by the Experimental Modal Analysis (EMA) to evaluate dynamic properties of tested structure. Based on the experimental data collection, dynamic properties of a research object were estimated. The modal parameters have been estimated using PolyMAX – module of LMS Test.Lab software.

Anatoly Sviridenok, Aliaksei Krautsevich, Olga Makarenko, Vladimir Voina
Structure and Adhesive Properties of Nanocomposites Based on Functionalized Nanofillers

Nanocomposite samples of the copolymer of ethylene and vinyl acetate containing carbon nanofibers and nanotubes have been prepared by mixing in solution. In order to improve interfacial interactions in the polymer-nanofiller system they were subjected to a preliminary chemical functionalization. The efficiency of functionalization was estimated by the IR spectroscopy. The X-ray diffraction and strength characteristics of the obtained nanocomposites filled by the untreated and functionalized carbon nanofibers and nanotubes with different filling degree were compared.

Krzysztof Wójcicki, Kazimierz Puciłowski, Zbigniew Kulesza
Mathematical Analysis for a New Tennis Ball Launcher

The paper presents the mathematical analysis for the design of a new tennis ball launcher in order to assess the possibilities for its technical implementation. First, traditional launchers are described. Next, several new requirements improving training possibilities of such machines are suggested. The motion equation of the flying tennis ball is formulated and numerically solved. This makes it possible to analyze the trajectories of the ball for different initial conditions: elevation and heading angles, as well as the rollers angle. Then, the mathematical analysis of the launcher with two counter rotating rollers is presented. Stiffness (Young's) modulus and friction coefficients for the typical tennis ball have been determined experimentally. Based on these, initial conditions for the throw have been found: rotating speeds of the rollers and powers of the driving motors.

Grzegorz Żywica
The Static Performance Analysis of the Foil Bearing Structure

Foil bearings are a variety of slide bearings, in which an extra compliant foil set is applied between journal and bush, in order to improve the selected static and dynamic properties. Bearings of this type are investigated by engineers and researchers from all over the world since many years – both from simulation as well as experimental point of view. Due to the complexity of construction, the reliable simulation models are still being searched for. This paper discusses the most important stages of elaboration of the structural supporting layer of the foil bearing as well as results of verification tests. The main goal of the conducted study was assessment of reliability of the elaborated numerical model, in order to ensure that in future it could play a role of a reliable research tool, which could be used for elaboration of the numerical model of the entire foil bearing.