ABSTRACTS

Krzysztof Augustynek
Modelling of Joints on Mechanisms by Means of Spring Elements

Mechanisms are examples of closed kinematic chains with a tree-like structure. In order to derive the equations of motion, closed kinematic chains have to be cut and constraint equations have to be formulated. As a result equations of motion form a set of differential-algebraic equations with index 3, which are difficult to solve. The paper presents a method modeling interactions between bodies at the cut joints by means of spring elements with appropriate stiffness. Such approach eliminates constraints equations, and thus the equations of motion form a set of ordinary differential equations.

Tomasz Boguszewski, Krzysztof Molski
Analysis of Stresses, COD and Energy Released Rate G for Symmetrically Branching Cracks

Mutual interactions between two neighboring singular stress fields for symmetrically branching cracks are analyzed. Using the finite element method and ANSYS program, relative crack opening displacements and range of validity of the singular stress fields have been obtained. Some special functions were chosen for describing crack face opening and calculating the energy release rate \( G \) and its particular components. Numerical results made it possible to explain the influence and applicability of stress intensity factors for such cracks and show qualitatively additional effects and cracking conditions around the crack tip for plane and anti-plane crack problems.

Krzysztof Ciechacki, Tadeusz Szykowny
Structure and Mechanical Properties of Welded Joints of Ferritic Steel X2CrNi12 with Austenitic Steel X5CrNi 18-10

The basic aim of this work is the connection of the microstructure of different joints with mechanical properties. In the range of mechanical properties the micro and macro hardness, impact tests, tensile and bendig strength of welded joints were measured. For microstructure investigations the light scanning electron microscopy SEM and X – ray diffraction methods were used. The ferritic X2CrNi12 and austenitic X5CrNi 18-10 steels in the form of 5 mm thick sheets were taken for investigation.

Michał Czech, Lesław Kyzioł
Influence of the Content of the Polymer for Anisotropy of the Wood Strength for Tensile

The criterion Tsai-Wu for anisotrophy materials in description of the wood and the composite strengths D-PMM related to the cutting angle of the specimens was applied. It was assumed that the strength curves run through the points denoting the strength in the principal axes of orthotrophy. The coefficients were deteminated by the least square method. Verification of the accuracy of the description was made on the base of the test F-Snedocor’a.

Zenon Hendzel, Marcin Szuster
Neural Dynamic Programming in Behavioural Control of a Wheeled Mobile Robot

In this paper an innovative approach to a collision-free trajectory generating for a wheeled mobile robot (WMR) with Neural Dynamic Programming (NDP) and Fuzzy Logic (FL) algorithms, is proposed. The presented hierarchical control system consists of a trajectory generating algorithm based on reactive navigation of the WMR in unknown 2D environment with static obstacles, and a tracking control system. A strategy of reactive navigation is developed including two main behaviours: obstacle avoiding behaviour (OA) and goal-seeking behaviour (GS) realized in a form of NDP algorithms. These simple, individual behaviours are combined by the fuzzy combiner of behaviours (CB), that determines influence of the individual behaviours according to environment conditions. A computer simulations of the proposed control algorithm have been conducted in virtual environment for the WMR Pioneer 2-DX.

Andrzej Kazberuk
Stress Intensity Factors at Crack Tips Located at Rounded V-Notch Vertex

The problem of the stress intensity factors for system of cracks emanating from infinite rounded V-notch apex subjected to tearing load was solved. Numerical values was obtained for two most important symmetrical cases – the single crack and the system of two cracks of equal length. The influence of the notch apex rounding radius on the stress intensity factors at crack tips was analyzed. The asymptotic solution which was obtained has general nature – stress concentration factors at the crack tip are expressed as a function of V-notch stress intensity factor, so this relationship could be used to estimate essential fracture mechanics parameters in the wide range of particular symmetrical problems of fracture of V-notched structural elements subjected to tearing loads.

Ewa Kulesza
Analysis of Corrosion Resistance of the Titanium Alloys Obtained by Powder Metallurgy Method

This article presents analysis of corrosion resistance of the titanium alloys obtained by powder metallurgy method. The potenciodynamic curves made from data obtained from the ATLAS 9933 ELEKtroCHEMICAL INTERFACE device were analyzed. Corrosion potentials and corrosion currents of sintered titanium were evaluated by the POL-99. The characteristics of corrosion of new titanium alloys and solid commercial alloy- Ti6Al4V were compared. It was found that corrosion potentials of sintered materials are displaced into higher potential than commercial alloy.
Tadeusz Łagoda, Karolina Walat

Methods of Realization of Service Loadings in the Control Systems of Fatigue Test Stands

The paper presents five methods of signal generation which can be applied for simulation of service loadings at fatigue test stands. They are: the method of block programs of cyclic loadings, the matrix method for generation of random loadings extrema, the congruence method for generation of random loadings and formation of their probabilistic characteristics with use of digital filters, the method of generation of random signals as a sum of harmonic histories according to the given spectral power density function, the method of random signal generation with the inverse Fourier transform according to the given spectral power density function.

Krzysztof Łukaszewicz, Walenty Osipiuk

The Fatigue Life Prediction of Notched Elements

The paper presents a method of evaluating of fatigue life under uniaxial loads conditions. Experiments verifying the above method have been conducted on INSTRON 8502 PLUS machine using steel C45 specimens. For testing applied disc specimens with radius cut under uniaxial loads state. In the calculations of coefficient β, utilization two well-known Neuber's and Peterson's dependences were executed.

Romuald Mosdorf, Tomasz Wyszkowski

Modelling of Synchronization of Air Bubbles Departing From Two Neighbouring Nozzles

Results of experimental investigation of interaction between bubble columns generated from two nozzles have been presented. The synchronization between departing bubbles has been observed for distance between nozzles equal to 5mm and bubble departure frequency equal to 30 Hz. The analysis of liquid flow regime between interacting bubbles has been made using the COMSOL Multiphysics program. The gas-liquid interface movement has been described using the level set method. The bubble departures from neighboring nozzles in the long period of time have been modeled using the set of ODE describing the changes of mass of gas in the gas supplying system. During the simulation, similarly to the experiment, the correlation between behaviors of two interacting chaotic systems has been observed.

Jerzy Nachimowicz, Robert Korbut

Energetic Aspects of Needle Bearings Work Performance

The paper presents the analysis of wear equation in energetic approach exemplified by a needle bearing of tractors third motion shaft. The authors analysed the influence of external factors on the type of wear in the function of time in frictional contact. Properties which are typical of deformed sections of friction surface have essential influence on the durability of the elements of friction couple. It is crucial to make the right choice of materials for friction elements which ought to have structure of the largest resistance to cracking as a result of external exploitation influences. This means that the material science of tribotechnology should be considered on the basis of microstructure analyses.

Grzegorz Pulawski

Influence of Variable Specific Heats of Working Fluid on Performance of Air Standard Otto, Diesel and Sabathe Cycles

This paper presents influence of variable specific heats of working fluid on the performance of air standard Otto, Diesel and Sabathe cycles. The mathematic models of air standard cycles with temperature dependent specific heats were made and compared to those which use constant specific heats. The results obtained in this study, presented in tables and charts, show significant variations between the performance of cycles with constant and variable specific heats of working fluid.

Maciej Słowik, Daniel Oldziej

Cognitive Architectures Survey of Methods and Implementations

Autonomous mobile robots are used in different new applications. These applications put different requirements on the autonomy tasks of robotic systems. The more advances in autonomy solutions are connected with these cognitive architectures. Cognitive architectures have build-in mechanisms, which can cope with new problems arriving in uncertain environments. In the paper three different cognitive architectures, implementations and simulation of them have been described and compared.

Heorgij Sulym, Wiktor Opanasowycz, Igor Jacyk

Bending of Reissner's Plate Containing Cracks with the Account of Their Faces Contact Zone Width

This paper considers the bending of unbounded isotropic plate loaded at infinity with uniformly distributed bending moments. The plate is weakened with three collinear cracks with traction-free faces. It is assumed that the crack faces are in a smooth contact on the top face of a plate along their length. The contact region for each crack has a constant height. Due to the contact of crack faces the solution of the problem is obtained as a superposition of two ones: plane stress problem and problem of Reissner plate bending. Basing on the complex variable method the system of singular integral equations is obtained. It is solved numerically using the mechanical quadrature technique. The analysis of numerical data is provided.

Tomasz J. Teleszewski, Sławomir A. Sorko

Application of Boundary Element Method for Solution of Two Dimensional Flows

Object of presented work is implementation of method of boundary integral equations to solving of viscous liquid flow problems. The computing algorithm for laminar flows of viscous liquid flows (Stokes flows) at use of method of the boundary integral equations consisting in to application of conjugate integral equations describing of speed and stresses in liquid to delimitation of stress at boundary conditions formulated for speed, to delimitation of speed from integral relationships, and in further order delimitation of the pressure, vorticity and stream function by utilization of differential relationships among these quantities and speed of movement of liquid. One represented results of solution of the test problem of flat flow in square cavity and one compared results of calculations of boundary element method with results of calculations with finite element method. One made comparisons streamlines obtained by experimental visualizations of the flows with stream function charts for row laminar flows in flat ducts with various configuration.
Adam Tomczyk
The Effect of Crack on Contact Pressure Distribution in a Plane Problem Accounting for Friction

The paper presents the solution of the problem of interaction between a rigid punch and an elastic half-space weakened by a single edge crack. It was assumed the parabolic or flat punch to analyze the influence of punch base shape. The contact pressure distributions were obtained for various values of distance between crack and punch, crack length and its orientation, Poisson ratio and also for various values of friction coefficient. A detailed influence of these parameters on contact zone size and its eccentricity is presented for the case of parabolic punch. It was found that assuming regular contact pressure distribution in the place where punch acting can produce considerable errors in many contact problems.

Adam Tomczyk
Experimental Investigations of Fatigue Crack Propagation in Polymethyl Methacrylate Specimen

The paper presents the results of experimental investigations of crack growth in PMMA V-notched plane specimens. A uniaxial (mode I) and biaxial (mode I + mode II) loading conditions are considered. It is described the effect of various loading values and also the effect of biaxiality of loading on crack growth rate and crack initiation and propagation directories. It was observed a three-stages process of crack propagation in brittle PMMA glass.

Grzegorz Wołkowycki
Experimental Determination of Fixed Matrix Regenerator Effectiveness Based on Operation Parameters of Regenerators Working at a Glass Meeting Furnace

This paper describes the regenerators, in which it is fitted with glass oven located in the Glassworks Huta BIAGLASS in Bialystok. Presents in detail the design of regenerators, thermophysical properties of filling and measuring equipment performance. Having shown how to determine the operational effectiveness of the test results regenerator.Posted on, the results of simulation the impact of measurement errors and the temperature of exhaust air volume so as to be fixed efficiency bug.

Robert Zabielski, Roman Trochimczuk
Chosen Problems of Design Procedures of High Speed Milling Electrospindle with Non -Standard Bearings

The analysis of basic problems considering structure and design of milling electrospindles with magnetic bearings was performed in the paper. The attention was especially paid to problems related to construction and proper selection of components of the system being designed. Moreover, general structure and applications of magnetic bearings was discussed, and advantages as well as disadvantages of using magnetic bearings in rotary machinery were defined. On this basis, two conceptions of electrospindle with magnetic bearings were proposed. Additionally, the paper describes general design procedure of complex mechatronic systems, as which the modern high speed electrospindles with magnetic bearings can be classified, proposed by R. Isermann.

Agata Zajkowska, Łukasz Derpeński, Andrzej Seweryn
Methods of Determination of Real Hardening Curve

The paper is devoted to real hardening curve determination. Two methods are used in this paper. In this part based on uniaxial tensile test – FEM. Material resilient-plastic model with isotropic hardening and Huber – von Mises plasticity condition was used to describe the relations between the tension and axial strain in researched samples in plastic range. Hardening curves was determined by means of multiply repeated numeric calculations taking the “neck” creation effect into consideration. Experiments were performed on aluminum alloy EN-AW 2024 and EN-AW 2007.

Agata Zajkowska, Łukasz Derpeński, Andrzej Seweryn
Methods of Determination of Real Hardening Curve

The paper is devoted to real hardening curve determination. Two methods are used in this paper. In this part based on spherical cyclical indentation test. The values of force and translocation measured during an experiment were used to determine the force-hollow curve and afterwards the force-plastic hollow curve. Basing on the force-plastic hollow relation, the material hardening curve was generated. Experiments were performed on aluminum alloy EN-AW 2024 and EN-AW 2007.

Krzysztof K. Żur
A New Idea of Modelling and Dynamic Analysis of a Man Walking Apparatus

In this paper a new idea of description and dynamic analysis of a man walking apparatus. Own mathematical model of a man walking apparatus in the space state was presented. Method of phase plane by using „phase effect of diagram” was used. During own investigation of young and old subjects were chosen from monograph elaborated by very famous Canadian investigator D.A. Winter (Winter, 1991, 2009). A new hypothesis about using a small phase loops for assessment of neuro-muscular coordination system of a man was proposed.