ABSTRACTS

Bogdan Korobko, Ievgen Vasyliev
The Test Method for Rheological Behavior of Mortar for Building Work

This paper offers a test method for rheological behavior of mortars with different mobility and different composition, which are used for execution of construction work. This method is based on investigation of the interaction between the valve ball and the mortar under study and allows quick defining of experimental variables for any composition of building mortars. Certain rheological behavior will permit to calculate the design parameters of machines for specific conditions of work performance – mixing (pre-operation), pressure generation, pumping to the work site, workpiece surfacing.

Cezary Kownacki Leszek Ambroziak
Flexible Structure Control Scheme of a UAVs Formation to Improve The Formation Stability During Maneuvers

One of the issues related to formation flights, which requires to be still discussed, is the stability of formation flight in turns, where the aerodynamic conditions can be substantially different for outer vehicles due to varying bank angles. Therefore, this paper pro-poses a decentralized control algorithm based on a leader as the reference point for followers, i.e. other UAVs and two flocking behaviors responsible for local position control, i.e. cohesion and repulsion. But opposite to other research in this area, the structure of the formation becomes flexible (structure is being reshaped and bent according to actual turn radius of the leader. During turns the structure is bent basing on concentred circles with different radiuses corresponding to relative locations of vehicles in the structure. Simultaneously, UAVs' airspeeds must be modified according to the length of turn radius to achieve the stability of the structure. The effectiveness of the algorithm is verified by the results of simulated flights of five UAVs.

Bogdan Sapiński
Laboratory Testing of Velocity Sensing in an MR Damper With Power Generation

The study summarises the results of experimental examination of velocity sensing capability in a prototype of a magnetorheological damper with power generation (MRD). The device has two main components: an electromagnetic power generator and an MR damper. The study outlines the structure of the device with the main focus on the generator part, and provides results of tests performed under the idle run. The discussion of demonstrates the potentials of MRD action as a velocity-sign sensor and presents key issues which need to be addressed to enable its real life applications.

Jerzy Narojczyk, Dmitrij Morozow
Modification of TiN coatings by Ion Implantation

The high-speed steel HS 6-5-2 cutting inserts coated with TiN were subjected to ion implantation with both silicon (dose 2x1017Si+/cm2) and silicon with nitrogen ions (dose (1+1)x1017(Si+ + N+)/cm2) on the subsurface layer of the rake face. Microhardness was examined before and after ion implantation. The composition and structural properties of the subsurface layer were examined by Glow Discharge Optical Emission Spectroscopy (GD-OES). The turning tests of 40H construction steel with the use of the cutting inserts implanted and non-implanted were performed. During the tests the two components of the net cutting force (the main cutting force Fc and feed force Ff) as well as the wear parameters VB on the major flankalong with the surface roughness (Ra) were measured. The implanted inserts exhibited higher durability compared to non-implanted ones.

Andrzej Waindok, Bronisław Tomczuk
Reluctance Network Model of a Permanent Magnet Tubular Motor

The reluctance network model of a permanent magnet tubular motor (PMTM) has been presented in the paper. The reluctance values of the magnetic circuit have been calculated with using analytical expressions. The air gap reluctance has been determined with using both analytical expressions and the finite element method (FEM). Using the calculation model, the flux values coupled with the windings have been obtained and used in the calculations of force value. The calculated results have been compared with numerical and measured ones.

Marek Wojciechowski
Minimal Kinematic Boundary Conditions for Computational Homogenization of the Permeability Coefficient

In the paper, computational homogenization approach is used for recognizing the macroscopic permeability from the microscopic representative volume element (RVE). Flow of water, at both macro and micro level, is assumed to be ruled by Darcy law. A special averaging constraint is used for numerical flow analysis in RVE, which allows to apply macroscopic pressure gradient without the necessity to use directly Dirichlet or Neumann boundary conditions. This approach allows arbitrarily shaped representative volumes and eliminates undesirable boundary effects. Generated effective permeability takes into account the structuring effects, what is an advantage over other homogenization methods, like self-consistent one.

Dmytro Fedorynenko, Serhii Sapon, Sergiy Boyko, Anastasiia Urlina
Increasing of Energy Efficiency of Spindles with Fluid Bearings

Promising ways of energy efficiency gain of spindles with fluid flow bearings are offered. New design of journal hybrid flow bearing which contains spherical bearing pockets and adjustable valves with relay control system is offered to improve energy efficiency of spindle units of machine tools. To reduce power losses of fluid bearings at high speed special lubrication based on water with integrated system of corrosion protection is offered. Results of theoretical research of energy consumption of grinding machine tool with a new design of spindle hybrid bearings are presented. Power losses of the spindle unit with both new design and base design of journal bearings are assessed. Effectiveness of new design of spindle hybrid bearings at high operating speeds is shown.

Marek Płaczek, Andrzej Wróbel, Andrzej Buchacz
Structural Tests of Freight Wagons on the Basis of Signals Generated By Piezoelectric Macro Fiber Composites

Paper presents a report of a research work that concerns possibilities of freight wagons modernization using new composite materials. The main aim of presented work was to verify the possibility of inference from the dynamic response of the wagon about the changes in its technical condition. During the presented works tests on real objects were carried out using Macro Fiber Composite (MFC) piezoelectric transducers glued to the freight wagon's frame. The dynamical response of the wagon was measured while the object was driving. On the next stage the measured signal was generated on a laboratory stand using electrodynamic modal shaker and vibrations of the laboratory model were measured. Measured signals were juxtaposed on charts and analysed. The aim of this work was to verify if it is possible to detect the change in the system using measurements of vibrations that are being generated during exploitation of the freight wagon.

Olena Mikulich, Vasyl' Shvabjuk, Heorgij Sulym
Dynamic Stress Concentration at the Boundary of an Incision at the Plate Under the Action of Weak Shock Waves

This paper proposes the novel technique for analysis of dynamic stress state of multi-connected infinite plates under the action of weak shock waves. For solution of the problem it uses the integral and discrete Fourier transforms. Calculation of transformed 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 algorithm is based on the method of mechanical quadratures and collocation technique. For calculation of originals of the dynamic stresses it uses modified discrete Fourier transform. The algorithm is effective in the analysis of the dynamic stress state of defective plates.

Andrzej Jurkiewicz, Janusz Kowal, Kamil Zając
Sky-Hook Control and Kalman Filtering in Nonlinear Model of Tracked Vehicle Suspension System

The essence of the undertaken topic is application of the continuous sky-hook control strategy and the Extended Kalman Filter as the state observer in the 2S1 tracked vehicle suspension system. The half-car model of this suspension system consists of seven logarithmic spiral springs and two magnetorheological dampers which has been described by the Bingham model. The applied continuous sky-hook control strategy considers nonlinear stiffness characteristic of the logarithmic spiral springs. The control is determined on estimates generated by the Extended Kalman Filter. Improve of ride comfort is verified by comparing simulation results, under the same driving conditions, of controlled and passive vehicle suspension systems.

Janusz Gołdasz, Bogdan Sapiński
Magnetostatic Analysis of a Pinch Mode Magnetorheological Valve

The study deals with the pinch mode of magnetorheological (MR) fluids' operation and its application in MR valves. By applying the principle in MR valves a highly non-uniform magnetic field can be generated in flow channels in such a way to solidify the portion of the material that is the nearest to the flow channel's walls. This is in contrary to well-known MR flow mode valves. The authors investigate a basic pinch mode valve in several fundamental configurations, and then examine their magnetic circuits through magnetostatic finite-element (FE) analysis. Flux density contour maps are revealed and basic performance figures calculated and analysed. The FE analysis results yield confidence in that the performance of MR pinch mode devices can be effectively controlled through electromagnetic means.

Rafał Mech, Jerzy Kaleta
Influence of Terfenol-D Powder Volume Fraction in Epoxy Matirx Composites on their Magnetomechanical Properies

In this paper the investigations of magnetostriction as well as DC magnetic properties for composites doped with Terfenol-D particles are presented. All investigations were performed for the materials with 35%, 46% and 70% volume fraction of the Terfenol-D particles surrounded by epoxy matrix. Moreover, the bulk Terfenol-D alloy was tested. The obtained results show that the magnetization of the composite materials ncreases with increasing the volume fraction of Terfenol-D particles. Similar dependence as for magnetization was observed for the magnetostriction measurements. Although the magnetostriction of composite material is smaller than for solid Terfenol-D it is still tens of times bigger than in case of traditional magnetostrictive materials. Obtained results gives opportunity to use these materials for variety applications such as actuators and sensors.

Mariusz Żokowski, Paweł Majewski, Jarosław Spychała
Detection Damage in Bearing System of Jet Engine Using the Vibroacoustic Method

The article discusses typical, operational systems for monitoring vibrations of jet engines, which constitute the propulsion of combat aircraft of the Armed Forces of the Republic of Poland. After that, the paper presents the stage of installing vibration measuring sensors in the direct area of one of the jet engine bearings, which is a support system for its rotor. The article discusses results of carried out analyses of data gathered during tests of the engine in the conditions a jet engine test bed. Results of detecting damages to the bearing, using sensors built in the direct area will be presented.

Martin Sturm, Lubomir Pesik
Determination of a Vibrating Bowl Feeder Dynamic Model and Mechanical Parameters

Vibrating conveyors also named bowl feeders are a common equipment for conveying goods into production systems. These systems are used for the supplying of a certain number of goods to an individual designed interface and simultaneously arranging a correct orientation of the goods conveyed by the same time. This type of conveyor is used in various industries, such as for example automotive industry, electronic industry and medical industry. The target of this article is to determine a dynamic model and mechanical parameters by means of testing, and a numerical simulation of a ready-to-operate conveyor under standard working conditions.