ABSTRACTS

Maciej Słowik, Tomasz Mrozek
Experimental Analysis of Navigational Precision For Dedicated GNSS Receivers

In the paper experimental investigations related with analysis of navigational precision of three chosen GNSS receivers are shown. Used receivers allow for measurement of navigational signals in following modes of operations: receiving signals from single-frequency GPS system, dual-frequency GPS/GLONASS system, and receiving signals from GPS constellation with use of differential measurements. In the last mode the base station and mobile receiver were configured for transmitting/receiving differential corrections by pair of industry-grade radio modems. The most important features and configuration of navigational receivers for conducted experiment are presented. Afterward the features of computer program designed especially for simultaneous acquisition, analysis of quality parameters and archiving of navigational signals are shown. The results of conducted investigations are also shown. For each of the receivers quantity and quality parameters such as maximum and minimum numbers of visible satellites and DOP (dilution of precision) parameters achieved during the experiment are given.

Agnieszka Mackiewicz, Grzegorz Sławiński, Tadeusz Niezgoda, Romuald Będziński
Numerical Analysis of the Risk of Neck Injuries Caused by IED Explosion under the Vehicle in Military Environments

As a result of an explosion under a military vehicle, the risk of threat to life and health of the crew increases. Examination of this event in terms of the security of soldiers comes down to a complex analysis of the mutual interaction of the body of a soldier, seating and structural elements of the vehicle. As a result, shock wave impacts can cause tremor resulting from the construction of the vehicle and acceleration of the passenger's body. This study attempts to analyze the impact of an explosion of an improvised explosive device (IED) under the military vehicle with the risk of cervical spine injuries of soldiers. The analysis was carried out using numerical methods in the LS-DYNA program and was carried out taking into account the variable displacement values and acceleration recorded during the\ explosion. The study used a model of the body of a soldier in the form of a Hybrid III 50th Male Dummy.

Aleksander Karolczuk
Ratcheting Simulation in a Titanium-Steel Bimetallic Plate Based on the Chaboche Hardening Model

The paper presents the results of fatigue loading simulation applied to bimetallic model using the Chaboche kinematic hardening rule. Three cases of simulations were performed: (i) without residual stresses; (ii) considering residual stresses and (iii) considering asymmetrical geometry of bimetal, i.e. cross area reducing under tension period of loading. Experimental results exhibit the ratcheting phenomenon in titanium-steel bimetallic specimens. The observed ratcheting phenomenon could be explained by the third case of simulation which is supported by detection of microcracks in the vicinity of welded area.

Emil Spišák, Janka Majerníková, Emília Duľová, Ľuboš Kaščák
Analysis of Plastic Deformation of Double Reduced Sheets

This paper discusses the causes and the effects of plastic deformation of double reduced sheets under uniaxial and biaxial loading. It focuses on the specific inhomogeneity and localization of plastic deformation, which is analysed in detail. The uniaxial and the hydraulic biaxial tensile tests were used for material testing and the results were compared and evaluated. The final part of the paper deals with the microstructure of material deformations.

Jan Jaworski, Tomasz Trzepieciński
Surface Layer Properties of Low-Alloy High-Speed Steel After Grinding

Investigations of the surface layer characteristics of selected kinds of low-alloy high-speed steel after grinding were carried out. They were carried out on the flat-surface grinder with a 95A24K grinding wheel without cooling. The influence of grinding parameters was defined especially for: the quantity of secondary austenite, surface roughness, microhardness and grinding efficiency with a large range of grinding parameters: grinding depth 0.005–0.035 mm, lengthwise feed 2–6 m/min, without a cross-feed on the whole width of the sample. It was found that improvement of grinding properties of low-alloy high-speed steels is possible by efficient selection of their chemical composition. The value of the grinding efficiency is conditioned by grinding forces, whose value has an impact on the grinding temperature. To ensure high quality of the tool surface layer (i.e. a smaller amount of secondary austenite, lack of wheel burn and micro-cracks) in the case of sharpening of tools made of low-alloy high-speed steel, the grinding temperature should be as low as possible.

Maria Kotełko, Artur Mołdawa
Impact Behaviour of Spot-Welded Thin-Walled Frusta

In the paper the dynamic response of thin-walled, spot-welded prismatic frusta subjected to axial impact load is investigated. The parametric study into the influence of several parameters on the energy absorption capability, expressed by some crashworthiness indicators is performed, using Finite Element simulations. FE model is validated by experimental results of quasi-static and dynamic (impact) tests. Results of initial study concerning influence of spot welds are presented. Some conclusions are derived from the parametric study into the influence of frustum angle and wall thickness upon the energy absorption capability.

Svyatoslav Litynskyy, Yuriy Muzychuk, Anatoliy Muzychuk
On the Numerical Solution of the Initial-Boundary Value Problem with Neumann Condition for the Wave Equation by the Use of the Laguerre Transform and Boundary Elements Method

The aim of this paper is the numerical analysis of the one of main part of car engine – piston sleeve. The first example is for piston sleeve made of metal matrix composite (MMC) A356R. The second improved material structure is layered. Both of them are comparison to the classical structure of piston sleeve made of Cr-Ni stainless steel. The layered material structure contains the anti-abrasion layer at the inner surface of piston sleeve, where the contact and friction is highest, FGM (functionally graded material) interface and the layer of virgin material on the outer surface made of A356R. The complex thermo-elastic model with Archard's condition as a wear law is proposed. The piston sleeve is modelling as a thin walled cylindrical axisymmetric shell. The coupled between the formulation of thermo-elasticity of cylindrical axisymmetric shell and the Archard's law with functionally changes of local hardness is proposed.

Andrzej Koszewnik, Krzysztof Wernio
Modelling and Testing of the Piezoelectric Beam as Energy Harvesting System

The paper describes modelling and testing of the piezoelectric beam as energy harvesting system. The cantilever beam with two piezo-elements glued onto its surface is considered in the paper. As result of carried out modal analysis of the beam the natural frequencies and modes shapes are determined. The obtained results in the way mentioned above allow to estimate such location of the piezo-actuator on the beam where the piezo generates maximal values of modal control forces. Experimental investigations carried out in the laboratory allow to verify results of natural frequencies obtained during simulation and also testing of the beam in order to obtain voltage from vibration with help of the piezo-harvester. The obtained values of voltage stored on the capacitor C_0 shown that the best results are achieved for the beam excited to vibration with third natural frequency, but the worst results for the beam oscillating with the first natural frequency.

Janette Brezinová, Anna Guzanová, Dagmar Draganovská, Pavlo O. Maruschak, Mariana Landová
Study of Selected Properties of Thermally Sprayed Coatings Containing WC and WB Hard Particles

The paper presents results of research of the essential characteristics of two kinds of advanced coatings applied by HVOF technology. One studied coating: WB-WC-Co (60-30-10%) contains two types of hard particles (WC and WB), the second coating is eco-friendly alternative to the previously used WC-based coatings, called "green carbides" with the composition WC-FeCrAl (85-15%). In green carbides coating the heavy metals (Co, Ni, NiCr) forming the binding matrix in conventional wear-resistant coatings are replaced by more environmentally friendly matrix based on FeCrAl alloy. On the coatings was carried out: metallographic analysis, measurement of thickness, micro-hardness, adhesion, resistance to thermal cyclic loading and adhesive wear resistance (pin-on-disk test). One thermal cycle consisted of heating the coatings to 600°C, dwell for 10 minutes, and subsequently cooling on the still air. The number of thermal cycles: 10. The base material was stainless steel AISI 316L, pretreatment prior to application of the coating: blasting with white corundum, application device JP-5000.

Wojciech Sikora, Krzysztof Michalczyk, Tomasz Machniewicz
A Study of the Preload Force in Metal-Elastomer Torsion Springs

Neidhart type suspension units composed of metal-elastomer torsion springs can be a good alternative to steel helical springs in applications such as vibration absorbers or vehicle suspension systems. Assembling this type of spring requires initial preload of the elastomeric working elements, which determines their operating properties.The results of experimental tests and numerical simulations concerning the preload of elastomeric working elements in Neidhart type suspension units are presented in the paper. The performed research made it possible to propose a new calculation model for determining the preload force value acting on the elastomeric cylindrical elements applied in this type of suspension unit. The results obtained using the proposed model exhibit good convergence with FEM simulation results within the range of the tested geometrical and material properties.

Daniel Pieniak, Agata Walczak, Agata M. Niewczas
Comparative Study of Wear Resistance of the Composite with Microhybrid Structure and Nanocomposite

The paper presents the results of investigations on the air gages dynamic characteristics in the measurement of the round profiles of motor cylinders. The principle of the measuring device is explained, and the analysis of the air gages dynamics is described. The results of dynamic calibration enabled to eliminate those configurations of air gages that may not meet the requirements of the measurement they were designed for. After the proper air gages were chosen, the entire system underwent the accuracy test and passed it successfully revealing the method accuracy better than 10% compared to the reference measurement.

Slawomir Duda, Damian Gasiorek, Grzegorz Gembalczyk, Slawomir Kciuk, Arkadiusz Mezyk
Mechatronic Device for Locomotor Training

This paper presents a novel mechatronic device to support a gait reeducation process. The conceptual works were done by the interdisciplinary design team. This collaboration allowed to perform a device that would connect the current findings in the fields of biomechanics and mechatronics. In the first part of the article shown a construction of the device which is based on the structure of an overhead travelling crane. The rest of the article contains the issues related to machine control system. In the prototype, the control of drive system is conducted by means of two RT-DAC4/PCI real time cards connected with a signal conditioning interface. Authors present the developed control algorithms and optimization process of the controller settings values. The summary contains a comparison of some numerical simulation results and experimental data from the sensors mounted on the device. The measurement data were obtained during the gait of a healthy person.

Jaroslav Homišin
Charakteristics of Pneumatic Tuners of Torsional Oscillation as a Result of Patent Activity

Mechanical systems with combustion engines, compressors, pumps and fans, can be characterized as torsional oscillating mechanical systems (TOMS). It is therefore necessary to control their dangerous torsional vibrations. It was confirmed that dangerous torsional vibration can be reduced to acceptable level by an appropriate adjustment, respectively by tuning the TOMS. According to several authors, the most appropriate way of system tuning is application of suitable flexible element, which is flexible shaft coupling. It turned out that one of the types of shaft couplings, which are particularly suited to meeting this objective are pneumatic flexible shaft couplings, to act as so-called pneumatic tuners of torsional oscillations. The issue of research and development of pneumatic tuners of torsional oscillations, among other things is, long-term in the focus of the author. The existence of tuners creates the opportunity to develop new ways of tuning torsional oscillating mechanical systems. The author of the scientific article will focus on the characteristics of developed pneumatic tuners of torsional oscillation in terms of their design, construction, function, significance advantages and conditions imposed on pneumatic tuners based on the results of his patent activity. Simultaneously provides information about the characteristic properties of pneumatic tuners of torsional oscillations in the general design.