ABSTRACTS

Łukasz Jastrzębski, Bogdan Sapiński

Electrical Interface for a Self-Powered MR Damper-Based Vibration Reduction System

The study investigates the behaviour of an electrical interface incorporated in a MR damper-based vibration reduction system powered with energy recovered from vibration. The interface, comprising the R, L and C elements, is connected between the coil in an electromagnetic electric generator and the control coil in the MR damper and its function is to convert the output voltage from the generator. The interface model was formulated and computer simulations were performed to find out how the parameters of the interface should influence the frequency responses of the vibration reduction system.

Marek Jałbrzykowski

Selected Issues Concerning Degradation of Material in the Production of Injection Molded Plastic Components

This paper presents the problem of thermal degradation of thermoplastic materials processed using the injection method. Attention was paid to the issue of the optimal selection of a dye for modifying the base materials. For the selected materials and dyes, derivatograph tests were performed in order to assess their thermal characteristics and breakdown kinetics. Additionally, tribological tests and microscope observations of selected samples were performed. The obtained test results suggest a diverse level of thermal processes in the analyzed materials. This is crucial for the appropriate selection of dyes for plastic materials. As it turned out, the tribological properties of materials can also influence the technological quality of the injected alloy.

Iryna Rakocha, Vasyl Popovych

The Mathematical Modelling and Investigation of the Thermoelastic State of the Three-Ply Thermosensitive Hollow Cylinder

Stationary temperature distribution in a three-layer infinite hollow cylinder based on the thermosensitive body model was determined. The cylinder is subjected to the steady temperature on the inner surface and on the outer one is present the convective heat exchange. In the second layer exist heat sources with parabolic dependence on radial coordinate. The components of the thermostressed state have been found. The influence of the temperature dependence of the thermal and mechanical components characteristics of materials on the temperature distribution has been investigated.

Emil Evin, Miroslav Tomáš, Marek Výrostek

Laser-Beam Welding Impact on the Deformation Properties of Stainless Steels When Used for Automotive Applications

Materials other than standard and advanced high strength steels are remarkable for the thin-walled structures of the car-body in recent years in order to safety enhancement, weight and emission reduction, corrosion resistance improvement. Thus, there are presented in the paper the deformation properties of laser welded austenitic AISI 304 and ferritic AISI 430 stainless steels compared to these one measured for the high strength low alloyed steel H220PD. The properties were researched by tensile test and 3-point bending test with fixed ends on specimens made of basic material and laser welded one. The specimens were welded by solid state fiber laser YLS-5000 in longitudinal direction (the load direction). The deformation properties such as strength, stiffness and deformation work were evaluated and compared. The strength and stiffness were calculated from tensile test results and the deformation work was calculated from both, tensile test and 3-point bending test results. There has been found only minor effect of laser welding to the deformation properties for high strength low alloyed steel H220PD and austenitic stainless steel AISI 304. Otherwise, the laser welding strongly influenced the deformation work of the ferritic stainless steel AISI 430 as well as the elongation at tensile test.

Krystyna Romaniak

Identifying the Isomorphism of Kinematic Chains

Identification of isomorphic kinematic chains is one of the key issues in researching the structure of mechanisms. As a result the structures which duplicate are eliminated and further research is carried out on kinematic chains that do not duplicate. This dilemma has been taken up by many scholars who have come up with a variety of ideas how to solve it. The review of the methods for identifying the isomorphism of kinematic chains suggested by researchers is contained in this study, including Hamming Number Technique, eigenvalues and eigenvectors, perimeter graphs, dividing and matching vertices. The spectrum of methods applied to the issue of identifying the isomorphism of mechanisms reflects the researchers’ efforts to obtain a precise result in the shortest time possible.

Robert Pała, Ihor Dzioba

Analysis of Stress Distribution in front of the Crack Tip in the Elements of Modified and Unmodified Cast Steel G17CrMo5-5

The article presents influence of modification of the low-alloy cast steel G17CrMo5-5 by rare earth metals on stress distribution in front of the crack at the initial moment of the crack extension. Experimental studies include determination of strength and fracture toughness characteristics for unmodified (UM) and modified (M) cast steel. In the numerical computations, experimentally tested specimens SEN(B) were modelled. The true stress–strain curves for the UM and M cast steel are used in the calculation. The stress distributions in front of the crack were calculated at the initial moment of the crack extension. On the basis of data on the particle size inclusions in the UM and M cast steel, and the calculated stress distributions was performed an assessment of the possibility of the occurrence of cleavage fracture. The analysis results indicate that at room temperature for the UM cast steel, there is a possibility of cleavage fracture, while for the M cast steel occurrence of cleavage fracture is negligible.
Szymon Hernik

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.

Magdalena Bucior, Lidia Gałda, Feliks Stachowicz, Władysław Zielecki
The Effect of Technological Parameters on Intensity of Shot Peening Process of 51CrV4 Steel

In the paper the effect of selected technological parameters of shot peening on process intensity of 51CrV4 steel was presented. The experiments were conducted according to statistical 3-level completed plan PS/DC 32. Technological parameters were changed in the range: shot peening time t = 1-3 min and pressure p = 0.2-0.4 MPa. In the article the analysis of experiment reproducibility, impact parameters significance and adequacy of equation were done. As the result of investigations the adequate equation was obtained describing the effect of technological parameters. Significant influence on process intensity was found in case of pressure and interaction of both analyzed technological parameters. The biggest energy of stream shots was gained at the maximum pressure of 0.4 MPa and the shot peening time of 3 minutes. As the result of analysis according to design of experiment (DOE) the adequate equation describing the dependencies between technological parameters and process intensity was found.

Katarzyna Ciesielczyk, Katarzyna Rzeszut
Local and Distortional Buckling of Axially Loaded Cold Rolled Sigma Profiles

In this paper the local and distortional buckling analyses of axially loaded cold-rolled channel and sigma profiles were performed. The critical buckling load was computed by solving the linear eigenvalue problem for different numerical models using Finite Element Method and simplified formulas implemented in Eurocode and proposed by Hancock and Schafer. The buckling analyses were conducted to prove that the sigma cross-section can be successfully replaced by channel cross-section with additional elastic supports placed in folds of the web. It was demonstrated that the folds in the web of the sigma cross-section (additional elastic supports) reduce the slenderness of the web. So, the critical distortional stress can be calculated based on analytical formulas derived for the channel cross-section taking into account the web height between the folds.

Andrzej Borawski

The braking system is one of the most important systems in any vehicle. Its proper functioning may determine the health and life of the people inside the vehicle as well as road users. Therefore, it is important to control the parameters which characterise the functioning of brakes changed as little as possible throughout their lifespan. Multiple instances of heating and cooling of the working components of the brake system as well as the environment they work in may impact their tribological properties. This article describes a method of evaluating the coefficient of friction and the wear speed of abrasive wear of friction working components of brakes. The methodology was developed on the basis of Taguchi’s method of process optimization.

Czesław Janusz Jermak, Mirosław Rucki
Dynamics of the Non-Contact Roundness Measurement with Air Gages

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.

Anna Kaspereczuk, Agnieszka Dardzińska
Comparative Evaluation of the Different Data Mining Techniques Used for the Medical Database

Data mining is the upcoming research area to solve various problems. Classification and finding association are two main steps in the field of data mining. In this paper, we use three classification algorithms: J48 (an open source Java implementation of C4.5 algorithm), Multilayer Perceptron - MLP (a modification of the standard linear perceptron) and Naïve Bayes (based on Bayes rule and a set of conditional independence assumptions) of the Weka interface. These classifiers have been used to choose the best algorithm based on the conditions of the voice disorders database. To find association rules over transactional medical database first we use aprori algorithm for frequent item set mining. These two initial steps of analysis will help to create the medical knowledgebase. The ultimate goal is to build a model, which can improve the way to read and interpret the existing data in medical database and future data as well.

Bogdan Sapinski
Observations of MR Fluid Clumping Behaviour in a Squeeze-Mode Damper

The study summarises the results of quasi-static experimental tests of an MR squeeze-mode damper prototype (MRSQD) performed at the MTS testing machine. Of particular interests was the influence of MR fluid clumping behaviour in the MRSQD working gap on the force output of the device. The MRSQD tests were assessed by measuring the damping force output at prescribed sinusoidal displacement inputs and at various (fixed) voltage levels resulting in the respective average current levels in the control coil. The influence of piston position offset on the damping force was also investigated. The collected data were shown in the form of damping force time histories and damping force-piston displacement loops and discussed with respect to MR fluid clumping behaviour.