ABSTRACTS

Mirosław Bocian, Jerzy Kaleta, Daniel Lewandowski, Michał Przybylski
Design Concept of Test Stand for Determining Properties of Magnetorheological Elastomers

Magnetorheological elastomers (MRE) are "SMART" materials that change their mechanical properties under influence of magnetic field. Thanks to that ability it is possible to create adaptive vibration dampers based on the MRE. To test vibration damping abilities of this material special test stand is required. This article presents design concept for such test stand with several options of testing.

Janette Brezinová, Anna Guzanová, Dagmar Draganovská, Marián Egri
Assessment Tribological Properties of Coatings Applied by HVOF Technology

In this article, the attention is paid to the HVOF (High Velocity Oxygen Fuel) thermal spraying method by which the progressive coatings are applied on basic material C15E (STN 412020). These coatings are based on C-17CO, WC-CO-Cr and Cr3C2-25NiCr. There was made determination of the chemical composition of the coatings and assessment of coatings quality - adhesion, microhardness, porosity and wear resistance at room temperature (21°C) and also at operational elevated temperature (900°C). Results of adhesive wear showed high quality of all evaluated coatings and their suitability to extreme tribological conditions.

Andrzej Kaczyński
An Anticrack in Transversely Isotropic Space

An absolutely rigid inclusion (anticrack) embedded in an unbound transversely isotropic elastic solid with the axis of elastic symmetry normal to the inclusion plane is considered. A general method of solving the anticrack problem is presented. Effective results have been achieved by constructing the appropriate harmonic potentials. With the use of the Fourier transform technique, the governing system of two-dimensional equations of Newtonian potential type for the stress jump functions on the opposite surfaces of the inclusion is obtained. For illustration, a complete solution to the problem of a penny-shaped anticrack under perpendicular tension at infinity is given and discussed from the point of view of material failure.

Cezary Kownacki
Real Flight Demonstration of Pitch and Roll Control for UAV Canyon Flights

The paper presents results of an experiment prepared to validate the autonomous control of obstacle avoidance designed for a micro UAV to fly in urban canyons. The idea of the obstacle avoidance assumes usage of two miniature laser rangefinders responsible for obstacle detection and range measurement. Measured ranges from obstacles placed on both sides of UAV can be used to simultaneous control of desired roll and pitch angles. Such combination of controls allows achieving high agility of UAV, because during a maneuver of obstacle avoidance UAV can make a turn and climb at the same time. In the experiment, controls of roll and pitch angles were verified separately to ensure high reliability of results and clearance of UAV behavior in the real flight. Because of lack of appropriate objects, which can be used as obstacles, laser rangefinders were directed vertically to the ground instead of the original horizontal configuration. So sensors determine ranges from the ground during a descent flight of UAV, and if their values are lower than defined threshold, it could be interpreted as obstacle detection. The experiment results present UAV behavior adequate to designed controls of roll and pitch angle. The vehicle turns in the opposite direction to the sensing axis of laser rangefinder detecting an obstacle and starts climbing when both sensors detect obstacles at the same range below the threshold.

Magdalena Łępicka, Małgorzata Grądzka-Dahlke
Effect of Heat Treatment and Plasma Nitriding on Corrosion Resistance of X90CrMoV18 Martensitic Stainless Steel

Reliability and durability assurance poses a serious challenge for surgical instruments manufacturers. Hard working conditions, such as intermittent contact with body fluids and hard bone tissues, as well as necessity to undergo frequent sterilisation processes, induce constant research into solutions capable of ensuring high wear resistance while maintaining satisfactory imperviousness to corrosion. Plasma nitriding is marked as the modern corrosion resistance improving method suitable for surgical instruments steels. The paper presents findings from the heat treated and plasma nitrided AISI 440B (PN EN or DIN X90CrMoV18) steel corrosion resistance studies. Three conventionally heat treated (quenched with tempering in 250, 390 or 605°C) and three additionally plasma nitrided in N2:H2 reaction gas mixture (50:50, 35:65 and 20:80 ratio, respectively) specimens groups were examined. Furthermore, the authors evaluated the effect of machining - polishing and sandblasting - on investigated steel corrosion resistance. Microscopic observations and electrochemical corrosion tests were performed using a variety of analytical techniques. Results showed that, in comparison to conventional heat treatment, plasma nitriding of 440B stainless steel does not significantly affect its corrosive characteristics as far as the uniform nitride layer over the entire detail surface is obtained. The layer heterogeneity results in intensification of corrosion processes, making the material even more susceptible to corrosion than after conventional heat treatment, and contributing to severe, visible even with the unaided eye damages development.

Łukasz Mazurkiewicz, Jerzy Małachowski, Krzysztof Damaziak, Paweł Baranowski, Paweł Gotowicki
Identification of Layers Distribution in the Composite Coupon Using Finite Element Method and Three Point Bending Test

The main objective of the study is to develop experimentally validated FE model and perform numerical analysis of layered composites made by hand lay-up techniques during tension and bending test. The research object is glass - polyester laminate made of four unidirectional layers. In order to validate the numerical models experimental test were performed. Due to the very different stiffness modulus in tension and bending loading the material properties obtained from standard test are not suitable to apply in numerical model. Significantly different behaviour compared to experimental test was obtained for tree point bending where the numerical model becomes too stiff. Simple coupons, relatively easy to manufacture presented in the paper have very low quality. The differences in actual and theoretical bending stiffness (obtained from tension stiffness) exceed 70%. In order to represent the actual structure the layers of the composite were divided by resin layers and also additional resin layer at the top and bottom of the model were defined. Single stage optimization process was used to adjust the material layout. After layer set-up modification very significant improvement can be seen for flexural behaviour.

Krzysztof Nowak
Dependence of Creep Failure Probability on the Length of Metallic Specimens

The occurrence of statistical size effect is considered for damage in creep conditions. The numerical and experimental analysis have been performed. The obtained results are ambiguous. Numerical models confirm the scale effect which can be statistical or deterministic one. But this effect has no experimental verification. It may suggest that the weakest link model cannot be applied in creep conditions. Explanation of this needs further investigations.

Yuriy Pyryev, Zofia Maria Piętak
The Analysis of Tribological Processes in the Inking Unit of the Offset Printing Machine

In this paper is proposed the mathematical description of the temperature distribution resulting from the friction between the two inking rollers (one of which is made off steel and the second one has elastic layer) in the offset printing machine. So-called in printing industry steel vibrator roller perform simultaneously rotary and reciprocating motion. This reciprocating motion is the main source of the heat generation. Using the Laplace transform method for heat conduction equations with boundary conditions taking into account the real processes taking place in the inking unit in contact area we obtained and analyzed the solution that could be useful for determination and regulation of parameters in order to decrease time of process stabilization.

Jerzy Rojek, Szymon Nosewicz, Katarzyna Pietrzak, Marcin Chmielewski
Simulation of Powder Sintering Using a Discrete Element Model

This paper presents numerical simulation of powder sintering. The numerical model introduced in this work employs the discrete element method which assumes that material can be modelled by a large assembly of discrete elements (particles) of spherical shape interacting among one another. Modelling of sintering requires introduction of the cohesive interaction among particles representing inter-particle sintering forces. Numerical studies of sintering have been combined with experimental studies which provided data for calibration and validation of the model. In the laboratory tests evolution of microstructure and density during sintering have been studied. Comparison of numerical and experimental results shows a good performance of the numerical model developed.

Bogdan Sapiński, Marcin Szczęch
CFD Model Of A Magnetorheological Fluid In The Squeeze Mode

The study briefly outlines a CFD model of a magnetorheological (MR) fluid operated in squeeze mode with a constant interface area using the CFD (Computational Fluid Dynamics) approach. The underlying assumption is that the MR fluid is placed between two surfaces of which at least one can be subject to a prescribed displacement or a force input. The widely employed Bingham model, which fails to take into account the yield stress variations depending on the height of the gap, has been modified. Computation data obtained in the ANSYS CFX environment are compared with experimental results.