

## ABSTRACTS

### **Elena Bezvesilnaya, Yuryj Podchashinsky, Alexandr Dobrozhansky**

#### *Requirements for airborne gravimetry system*

In the article the requirements to system for airborne gravimetry are formulated. A system for airborne gravimetry must consist of five functional subsystems for 1) specific force measurement, 2) geometric stabilization, 3) terrestrial navigation, 4) altimetry, and 5) computation. The general error of measurements of gravitational anomalies does not exceed 10 mgal. The accuracy requirement to main bodies of the block diagram of system for airborne gravimetry are determined ba-sed on analysis of errors of measurements.

### **Elena Bezvesilnaya, Yuryj Podchashinsky, Igor Korobyjchuk**

#### *Gravimeter with two-dimension digital processing of measuring information*

Gravimeter with two-dimensional digital data processing about acceleration of gravity is considered in a paper. The result of measurements in gyrosopic gravimeter contains errors. An influence on gravimeter inertial absolute acceleration and other disturbing influences cause the errors of measurements. These of acceleration arise by work gravimeter onboard the plane in structure of air gravimetric system. The structural scheme of gyrosopic gravimeter is proposed in a paper for multiple precision. This construction is providing immediate measurements of acceleration of gravity. The possibility of digital data processing is considered in view of a two-dimensional character of an array of measuring information.

### **Mariusz Bogdan, Józef Blachnio, Marcin Derlatka**

#### *Computer-aided method of diagnostics of gas turbine blades*

The article presents a computer-aided method of diagnostics of gas turbine blades with use of artificial neural networks. The subject of presentation is the developed neural network, with help of which – on the basis of features of blade surface images – realised is determination of their condition (operable element – inoperable element). Basing on conclusions formulated on the basis of microstructure examinations and concerning evaluation of state of overheating (blades suitable and not suitable for further operation), as patterns assumed were surface images representing blades in various states (neural pattern classification). Additionally, combining and segregating (according to their applicability for the network teaching process) image parameters, acquired from histograms as well as from matrix of events, automated and increased was the credibility (computer aiding) of decision process. The application of artificial neural network enables better representation of complex relations between blade image and its condition, than in the case of subjective methods used currently by diagnosticians.

### **Henryk Borowczyk, Paweł Lindstedt, Janusz Magier**

#### *A method of reliability characteristics estimation on the basis of adjustment and diagnostic information*

The paper presents innovative method of reliability characteristics estimation on the basis of symptoms of parametric and temporary defects (prior to occurrence of catastrophic defects). The method is based on evident relations between adjustment, diagnostics and reliability, which are observed in an organised system of utilisation of each complex technical object.

### **Sergey G. Chulkin, Aleksandr D. Breki, Irina V. Soloviova, Mikhail M. Radkevich**

#### *Research of base and alloyed oil MC-20 influence on the tribotechnical characteristics of roller bearings*

This article is devoted to research of the influence of an oil additive "serpentine" on to roller bearings friction behavior. In this article the influence of the additive «serpentine» on the roller bearings (208 series) friction behaviour is considered. It has been established that the serpentine addition to the oil MC-20 allowed to reduce friction losses at the start-up of the mechanism 15-20% in comparison with the base oil.

### **Mykolas Daunys, Povilas Krasauskas, Romualdas Dundulis**

#### *Fracture toughness of 19Mn5 steel pipe welded joints materials*

This paper presents an investigation of Ignalina NPP reactor's main circulated circuit (MCC) pipeline welded joints materials fracture toughness properties. Standard compact C(T)-1T specimens containing "V" and "K" – type welds were cut off from the various MCC pipe's zones, produced from the 19Mn5 steel pipe and welded by electrodes UTP-068HH, YONI-13/55 and CT-36. Critical J – integrat  $J_{Ic}$  values were defined Rusing  $J-R$  curve test method, which results on determination of J – integral values as a function of crack extension  $\Delta a$ . The investigation enables to calculate critical crack length  $\Delta a_{max}$  and  $\Delta a_c$  sizes and J – integral  $J_{Ic}$ ,  $J_{max}$  and  $J_{Pmax}$  values, which are used to predict safe service lifetime of the cracked pipelines.

### **Tomasz Dzitkowski, Andrzej Dymarek**

#### *Synthesis and sensitivity of multiaxial drive systems*

The selection of the dynamical properties of machines is one of the methods enhancing their durability and reliability. Such task may be accomplished with the use of the analysis and synthesis algorithm. Accordingly, the issue of the synthesis, enabling the determination of the parameters and structure of the systems in view of their dynamical characteristics, may be applied as a tool supporting the design process under any operating conditions. The scope of discussion is the mixed method of synthesizing dynamic characteristics enabling the derivation of the parameters and models of drive systems.

**Sezgin Ersoy, Sertaç Görgülü**

*Computer based education and progress alternative for electro-mechanics lesson*

The rapid developments in technology make it costly to educate the work force for the sectors. In modern technology and in today's world in which the education system is more modern and the need for modern stuff is increasingly high, Computer-Based Education (CBE) techniques and software are no more a luxury but a necessity. Because these softwares become the basic component and means of easy and comprehensible manner of telling in modern education system due to the visuality that they concern. This study presents the examples of material to make the content and the subject of electromechanics more effective and comprehensible.

**Piotr Grześ**

*Finite element analysis of disc temperature during braking process*

The aim of this paper was to investigate the temperature fields of the solid disc brake during short, emergency braking. The standard Galerkin weighted residual algorithm was used to discretize the parabolic heat transfer equation. The finite element simulation for two-dimensional model was performed due to the heat flux ratio constantly distributed in circumferential direction. Two types of disc brake assembly with appropriate boundary and initial conditions were developed. Results of calculations for the temperature expansion in axial and radial directions are presented. The effect of the angular velocity and the contact pressure evolution on temperature rise of disc brake was investigated. It was found that presented finite element technique for two-dimensional model with particular assumption in operation and boundary conditions validates with so far achievements in this field.

**Andrzej Katunin, Anna Korczak**

*The possibility of application of B-spline family wavelets in diagnostic signal processing*

Nowadays, wavelets are widely used in many applications, e.g. signal processing. The application of wavelet transform allows to obtain considerably more information about technical state of machine (especially for non-stationary signals) than traditional methods, e.g. Fourier transform. The aim of the paper is to analyze the goodness of B-spline family wavelets in diagnostic signal processing. Three types of B-spline wavelets were investigated. Their applicability was verified using degree of scalogram density on synthetic and operational signals. Results of the analysis of B-spline family wavelets show that proposed approach gives more accurate results in comparison with other chosen wavelets and can be applied in industrial diagnostics.

**Robert Litwinko, Wiera Oliferuk**

*Yield point determination based on thermomechanical behaviour of polycrystalline material under uniaxial loading*

The paper is devoted to yield point determination based on the thermomechanical coupling that takes place in the material during its uniaxial tension. Experiments were performed on aluminum alloy and on austenitic steels. The stress value corresponding to the temperature minimum is treated as the critical resolved stress at which plastic deformation on the macroscopic scale begins. The obtained results are compared with values of stress which produces the irreversible strain equal to 0.2%. Such value of the stress is usually regarded as the yield point determined from the stress-strain curve. It is found that the values of yield point determined on the ground of the thermomechanical coupling are lower than these obtained from stress-strain curve.

**Stanisław Piróg, Tomasz Siostrzonek, Marcin Baszyński, Jarosław Czekoński**

*The control system of the flywheel energy storage*

In this article authors described the control system for Flywheel Energy Storage. The device consists of the power electronic system and control system. The control system based on the FPGA. The power electronic system consists of the special rectifier and converter.

**Małgorzata Poniatońska**

*Determining the uncertainty of the object coordinate system position in coordinate measurements of free-form surfaces*

Coordinate measurements are a source of digital data in the form of coordinates of measurement points with a discrete distribution on the measured surface. Geometric deviations of free-form surfaces are determined at each point as normal deviations of these points from the nominal surface (a CAD model). The calculations are preceded by fitting the measurement data to the CAD model. The relations between the object coordinate system and the coordinate system of the machine are described by the transformation parameters. This paper presents the idea of the process of data fitting with the use of the least square algorithm method as well as the way of determining the uncertainty on the assumption that transformation parameters are subject to a multivariate normal probability distribution. The theoretical issues were verified by experiments carried out on a free-form surface obtained in the milling process and characterised by random geometric deviations.

**Paweł Skalski, Krzysztof Woźnica, Jerzy Bajkowski**

*Parameters identification of bodner-partom model for fluid in MR damper*

This paper presents an approach to describe a dynamic behaviour of magnetorheological damper by the Bodner-Partom constitutive law. The B-P equations usually used for metals are presented for shear stresses to express viscoplastic properties of MR fluid. Material parameters for the B-P law for fluid in the LORD RD 1005-3 damper are determined. Experimental results are compared with numerical results.

**Valentyn Skalsky, Oleh Serhiyenko, Denys Rudavskyy, Yuriy Matviyiv**

*Estimation of diagnostics of fibers failure in composite materials by the method of acoustic emission*

The model of acoustic emission caused by formation of penny-shaped cracks in fiber composite materials taking into account stress relaxation in breaking fibers is proposed. It is found that the maximal values of components of displacement vector are directly proportional to the total area of defect, which is formed, and inverse proportional to the relaxation time.

**Vasiliy Stavrov, Vladimir Lashkovski, Anatoly Sviridenok**

*A biomechanical model of operated achilles tendon*

The paper discusses a biomechanical model reflecting deformation and tear of a tendon part, namely, elliptic in cross-section strand formed by stochastically located collagen fibers whose strain to stress relation obeys the exponential law. Recovery of the tendon by a plastic reinforcement is shown to result in elevated rigidity and shorter limiting elongation of the strand proportionally to the reinforced portion length, the strength of the restored strand being preserved almost fully. The limiting deformation of the recovered strand made with incisions for adaptation of the ends increases the more the deeper are the incisions, their number and the total length of the areas being adapted. This, nevertheless, decreases essentially the breaking load during further loading.

**Tomasz Sudakowski**

*Premises of operational method of calculation of reliability of machines on the base of parametric and momentary symptoms of damage*

In the article presented was the practical method of calculation of standard reliability characteristics of technical objects of unchanging and changeable structure during their work, based only on parametric and momentary symptoms of damage, the method of determination of symptoms of parametric damage on the base of diagnostic and momentary information and on the base of information about the state of adjustment of the object.

**Heorhiy Sulym, Iaroslav Pasternak**

*Self-regular stress integral equations for the axisymmetric elasticity*

The stress hypersingular integral equations of axisymmetric elasticity are considered. The singular and hypersingular integrals are regularized using the imposition of auxiliary polynomial solution, and self-regular integral equations are obtained for bounded and unbounded domains. The stress-BEM formulation is considered basing on the proposed equations. Considered numerical examples show high efficiency of the proposed approach. New problem for inclusion in finite cylinder is considered.

**Kirill Voynov, Helen Chertok**

*Ball pump*

A new and very effective ball pump is created. It can pump across the different liquids, for example: water, lubricants, oil, glycerine and even blood. Moreover it works not only like a pump but as a hydro-machine which can be applied in the various systems, namely, locomotives, robots and so on.