ABSTRACTS

Marcin Bajkowski, Robert Zalewski
Dynamic analysis of specjal object model with MR damper

Presented work concerns a dynamic analysis of the special object model where a traditional elastic-frictional damper is replaced by an MR damper. To realize previously mentioned aim a mechanical scheme of the real object has been developed. Then the dynamic model has been proposed including the prototype of an MR damper substituting a classical solution. For such a model a movement equations have been formulated. Afterwards numerical simulations have been conducted. Typical experimental results have been presented.

Zdzisław Bogdanowicz, Krzysztof Grzelak
Service properties of valve steels laser pad welded with stellite powder

The article presents experimental results of the selected service properties of laser pad welded stellite layers deposited on the surface of specimens made of steel: X53CrMnNiN 21-9 and X43CrSi 9-3.Additionally, laser, plasma and TIG overlayer welding stellite layers were subjected testings also the material in the initial state without the plotted stellite layer was investi-gated.

Zbigniew Dąbrowski
General formulation of the task of the nonlinear model identification

In the paper it was considered the thesis that nonlinear dynamic model can be identified with sufficient accuracy using coherence technique of nonlinear disturbance measure. Finally the methodological proposal is given.

Hubert Dębski, Józef Jonak
Thermally coupled FEM analysis of diesel engine components

The paper contains results of numerical analysis of stress, temperature and deformation distributions in diesel engine components, performed by means of MES. The scope of calculations include thermally coupled analysis of structural components, in which linear elastic properties and geometrically nonlinear problems were taken into account. The application of thermally coupled analysis, which enabled to consider simulta-neously thermal fields and related deformation distributions, had a significant effect on the results obtained. Such approach enables to carry out a complex analysis of thermally loaded structures and requires application of special type elements with an additional degree of freedom to take thermal problems into consideration.

Marek Fligiel
Optimal shaping of structure of design elements such as plate

We consider two optimal methods of the structure shaping of plate type design elements in the paper. We use the constitutive relations results from tensor calculations in the first method, In the second method generalized Hook's law is used to describe the stress and deformation fields. The Lagrange's functional is used in the mathematical model of the optimization. As the example, the searching of structure of design elements under the variable one fold or two folds loading by stiffness and dimensions side constrains.

Rafał Gawarkiewicz, Michał Wasilczuk
FEM analysis of deformed joint of ship a loader

Selected problems of calculations of structural joint of a ship loader, which was deformed, are described in the paper. Numerous numerical analysis were carried out to identify reasons of observed shapes of deformation. Next safety of the joint was estimated and simple way of repair and modernization to improve safety of the joint were proposed. The whole analysis was carried out with the use of ANSYS FEM package.

Sebastian Głowala, Bogdan Branowski
Research on slotted conical disc springs modelling

The following work analyses analytical models of conical disc springs with reference to own research. New ap-proach to calculation of characteristics of conical disc springs with a large undercut has been presented. Model includes a half-joint occurring where the conical disc spring joins and trapezoidal springs. Simplified models of calculations of trapezoidal springs characteristics have been also suggested.

Sebastian Głowala, Bogdan Branowski
New method of construction families building (spring relief systems of garage gates)

The following work presents the method of management of variants in the process of products development through identification of the causes of diversity and application of the correct varianting principles. The analysis of product proc-esses has been applied that allows for building the family of parts (springs) ordered in parametered catalogues. This work analyses the most commonly applied relief structure of bending cylinder screw springs made of wire with circle-section with initial tension of coils. The statistical analysis, as well as the series of types of garage gates built according to the principles known allowed for the further development of the new approach to designing the mixed series of types.

Andrzej Kosior
Hysteresis loop joint elastic strip in the rigid clamp obtained with irregular distribution pressure

In the work presented of physical model of the system with joint elastic strip in the rigid clamp. Irregular distribution pressure between elastic strip and rigid clamp, taking structural friction into account is presented. During load, relieve and again load free part of the strip, displacement in a function of the longitudinal force external was determined. The obtained dependences of the displacement enable determination of the hysteresis loop describes elasto-frictional properties of the joint.

Marcin Kowalczyk, Jerzy Czmochowski, Eugeniusz Rusiński
Analysis of the crack reason of the counterweight boom suspension of the multibucket excavator

The crack of the counterweight suspension has caused the serious failure of the multibucket wheel excavator in the coal mine. In order to determine the reason of the cracking the simulation research was conducted with use of modern numerical method for loading determined according to actual standards. Moreover the material testing of elements where the crack appeared was also conducted. Strength calculations and the analy-sis of the crack area have indicated the constructional and techno-logical failures.

Marcin Kowalczyk, Tadeusz Smolnicki, Mariusz Stańco
Strength designing of supporting structure joint of surface mining machines

Nowadays supporting structures of newly build basic machines of open cast mining undergo thorough strength analysis with use of finite element method (Rusiński et al., 2000). In case of verification calculations the occurrence of allowable stresses exceed is stated, where the structure changes are made in final stage of designing. In order to correct the structure the nonstan-dardized constructional operations are used very often.

Bogdan Ligaj, Grzegorz Szala
A fatigue life calculation method of constructional elements with a use of two - parametric fatigue characteristics

Suitable damage accumulation hypothesis and suitable fatigue life characteristics of a material should be assumed in fatigue life calculations of constructional elements in servis conditions under random loading with a wide-band spectrum. The paper presents the algorithm of fatigue life calculations based on two-parametric fatigue life characteristics. Description of the method and the algorithm was performed on the example of fati-gue life calculations of a constructional element made of D16CzATW aluminum alloy.

Grzegorz Mieczkowski, Krzysztof Molski
Energy release rate G as a fracture parameter of a bimaterial structure steel-PMMA with interfacial crack

The present paper deals with experimental approach to critical quasi-static and fatigue fracture conditions for a bi-material structure steel-PMMA with interfacial crack under complex stress state along the bond. Seven different types of samples were used of various crack lengths and different inclination angles of the bond with respect to the loading direction. Critical values G_c of the energy release rate were determined for all types of specimens using numerical FEM approach and consi-dering maximal forces obtained experimentally. Analysis performed has shown that G_c values were not constant for all types of specimens. Since G_c depends on the inclination angle of the bond some other fracture criteria should be developed to increase accuracy of theoretical models describing fracture processes of interfacial cracks.

Jerzy Nachimowicz, Mikołaj Plewa
An investigation on influence of technical parameters on braking effectiveness of disk and band brakes

The paper presents results of investigations on influence of technical parameters on effectiveness of braking. The influence of some arbitrarily chosen technical parameters on effectiveness of braking was analyzed. Band material, band tension for band brake and compressive force for disk brake were considered. Braking moment for different types of brakes and parameters used was measured and calculated.

Idzi Nowotarski
Nonlinear analysis of self-excited vibrationsof a cylindrical shell in supersonic flow

The paper presents the results of analysis of self-excited vibrations of a cylindrical shell of finite length exposed to external supersonic flow. The solution of the equations of motion is obtained and the equation of frequencies is derived. In addition, the results obtained from numerical calculations in respect to researched aspects were presented.

Małgorzata Poniatowska
Spatial characteristics of geometric deviations determined in coordinate measurements of free-form surfaces

Coordinate measurements are the source of digital data in the form of coordinates of the measurement points of a discrete distribution on the measured surface. The geometric deviations of freeform surfaces are determined at each point as normal devia-tions of these points from the nominal surface (the CAD model). Different sources of errors in the production process result in deviations of different character, deterministic and random. The contribution of random phenomena on the surface depends on the type of processing. The article suggests applying the methods of analysis of spatial data in research on the geometric devia-tions randomness of freeform surfaces, consisting in testing their spatial interrelations. In tests of spatial autocorrelation of milled surface geometric deviations Moran I statistics was applied.

Ryszard Rohatyński
Formulation of optimization problems in machine design – Part I. Decomposition and development of calculation algorithms

The paper commences with presentation of fundamental principles of mathematical formulation of optimization problems. Then application of incidence matrices to decomposition of complex optimization problems has been described. Finally, a new method of development of calculation algorithms for ele-ments and units of machines has been outlined.

Ryszard Rohatyński
Formulation of optimization problems in machine design – Part II. Reduction of the problem dimension and sensitivity investigation

The paper describes application of the monotonicity of the objective function and inequality constraints with respect to the design variables to the reduction of the mathematical opti-mization model dimension. Then a method of selection of pareto-optimal solutions has been outlined, which is based on the sensi-tivity of the solutions to their deviations from the poly-optimal values.

Marek Romanowicz

Micromechanical modelling of the nonlinear stress-strain behavior in glass/epoxy lamina subjected to transverse compression

Using micromechanics models, which take into account existence of a interphase region, the nonlinear stress strain relationship for a glass/epoxy lamina subjected to transverse compression was determined in this paper. To compute stress for given strain, the three phased unit cell with a hexagonal symmetry that accounts for imperfect interface condition and nonlinear finite element method were employed. An identification of failure mechanisms from micromechanics models was presented. A general assumption that mechanisms of plastic deformation along shear bands in matrix and fiber matrix debonding are re-sponsible for the nonlinear stress-strain behavior in glass/epoxy lamina subjected to transverse compression was validated. To predict the damage evolution in the epoxy matrix and the development of interface debonding, the Mohr Coulomb criterion was used. Model predictions were compared with experimental results for glass/epoxy lamina.

Paweł Romanowicz, Andrzej P. Zieliński

Application of multiaxial high-cycle criteria to rolling contact problems with frictio

Application and comparison of multiaxial high-cycle fatigue hypotheses used in free rolling and tractive rolling contact problems of a crane wheel was presented in paper. Calculations were made using the Finite Element Method (ANSYS®). It made possible computation of distribution of stresses in time.

Jan Ryś

Typification of planetary gear with simlpifying manufacturing technology

The aim of this article is to present design procedure of basic serious planetary gear train with external involutes spur gears. One can use a typical gear hobbing machine and generation grinding to manufacture the presented planetary gear. Then, the manufactured external gears can be subjected to carbonizing, and also hardening and tempering. It is possible to obtain a better dimensional accuracy thanks to grinding process (it is impossible for internal gears). Therefore, after heating treatment, the con-struction of the planetary gear is characterized by a higher load-carrying capacity. Next at the same gearbox can be used to differ-ent unite of wheels by typification process. There two conceptions i.e. design a planetary gear: with the same geometry of satellite wheels, which cooperate with sun gear and central gear with dif-ferent number of teeth (concept 1) or using the same geometry of sun gear and central gear and different number satellite teeth (concept 2). Geometrical dimensions of teeth for concept 2 and basic transmission ratio will be described for the sake of techno-logical teeth correction scope.

Jan Sikora

Correlation analysis of results of plain bearing fatigue investigations

A correlation analysis of results of plain bearing fatigue tests, that were performed in accordance with ISO standards, have been presented in the paper. Estimated boundary values of tangential stresses in surface layers of slide bearing bushes were objects of the analysis. The bushes were investigated in different devices: SKMR-2 fatigue tester (according to ISO 7905/4 standard) and MWO and SMOK bearing testing machines (under condi-tions of full fluid lubrication). It has been proved that the results of fatigue experiments performed on rigs of different pattern of load generation are not directly comparable though they dem-onstrate the same order of various bearing materials from the viewpoint of fatigue resistance.

Grzegorz SZALA, Bogdan LIGAJ

Calculations of energy requirements in crumbling processes of grain materials on the example of wheat grains

The paper presents the metod of calculations of energy requirements on the example of multiplate and multidrum grinders where technological shear of wheat grains is a dominant process.

Lucjan Śnieżek

Experimental analysis of fatig life of industrial pipelines

The paper concerns the research on the fatigue cracking and strength of steels used in the structure of a pipeline – both a new one and after years of service. Research results showed a decrease in fatigue strength, which was caused mainly by the degradation of the structure of the material being serviced. The observed decrease in the strength of specimens thad had semieliptic crack initiators was of 24-32% under alternating tension, in accordance with a block program of stress changes that was developed on the basis of the cause of actual service load of the pipeline being tested.

Karolina Walat, Tadeusz Łagoda

Designing of machine elements under complex stress state including the covariance maximum

Correct estimation of fatigue life of many elements seems to be a very important problem of modern technology. There are many multiaxial fatigue criteria which allow to study and solve problems connected with fatigue and systematize procedures and algorithms for fatigue life estimation. The paper presents methods of designing machine elements under complex stress state including the covariance maximum as a factor strongly influencing selection of the algorithm for fatigue life estimation.

Izabela Wilczewska, Roman Kaczyński

The identifications of friction and wear processes of polymers strengthen with carbon fibers in different environments

In the paper results of: experimental researches, microscopic analysis and chemical constitution of two tribological couples consist of: plastic strengthen with carbon fibers and bearing steel, working in three environments: air, water and oil, were presented. The researches were executed using T-11 tribotester machine, where pin-on-disc frictional couple scheme was realized. In the paper, identification of wear type of polymers strengthen with carbon fibers working in different environments, was under-taken. The short analysis of friction and wear phenomenon of composites was presented taking into consideration the binary scheme work of analyzed friction couples.

Grzegorz Wojnar
Analysis of usefulness of different vibrations signals for toothed gear diagnostics

Since toothed gears are universally used in drive transmission systems, lots of scientific research centers around the world try to perfect methods of vibration analysis (vibration signals are used to diagnose these drive elements). Another equally important issue is how to select an appropriate vibration signal carrying highest possible amount of information on advancing degradation process. For this reason the current work deals with comparison of usefulness of some vibration signals generated by toothed gear in bearings and gear wheels fault detection. Recommendations how to use some signals in gear elements fault detection are set in the paper as well.

Jerzy WRÓBEL, Konrad OKULICZ
Non classical approach to optimization problems with the application of virtual reality tools

The critical revue of papers devoted classical mathematical approach to optimization problems in the design process is presented. The general design principles formulated by profes-sor Osiński are described together with their mathematical de-scription. The non classical mathematical approach to optimiza-tion problems in the design process is proposed. This approach is based on realistic simulation generated in virtual reality environment and active participation of decision makers in design process. The optimization of assembling process of gear box is considered as an example of this approach.

Robert Zalewski
Viscoplastic constitutive models for special granular structures

Presented work is the next stage of considerations related to innovative semi-intelligent structures composed on the basis of granular materials. Loose granular material is initially placed in a hermetic plastomers envelope, where in the next step so called “underpressure” is generated.

Michał Żebrowski-Kozioł, Wojciech Tarnowski
Troubleshooting of the plays in ball-joints of the front suspension of vehicles

A measurement system for identification of plays in ball-joints is presented. It was designed and realized on accelerometric sensors. Overall errors are less than 0,3%. Testing ex-periments have proved its applicability for car diagnostic stations.