

STRESZCZENIA

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MULTICRITERIA OPTIMIZATION OF METAL CUTTING MACHINE'S MAIN DRIVE

A parametric optimization problem is formulated for the metal cutting machine main drive as a multicriteria nonlinear optimization problem of robust dynamical system. A mathematical model determining amplitude-frequency characteristics of torsional forced-vibrations of the main drive is developed. An assessment system of the vibrational stability is presented. A procedure determining the unique Pareto optimal solution by means of direct approach and a compromising scheme based on the concept of the "utopical" point in the criteria space and procedure for a "μ-selection" are utilized for approximately solving the formulated problem. An example which considers the parametric optimization for the main drive of CNC machine CE063 is included.

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PRINCIPAL STRAIN SEPARATION ON COATED SPECIMEN

This paper deals with principal strain separation with strain gages. A normal-incidence photoelastic measurement on the PhotoStress coating provides the difference in principal strains at the test point. If the sum of the principal strains can be measured at the same point, then the separate principal strains are obtainable by simply adding and subtracting the two measurements. The measurement is performed on coated specimen.

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INCREASE OF ACCURACY OF LINEAR ACCELEROMETERS USING OF ARTIFICIAL NEURAL NETWORK

In the article the algorithmic method of increase of accuracy of linear accelerometers is considered. In the gyroscopic accelerometer the angle of deviation of a sensing element consists of a constant and variable making. The constant making is proportional to acceleration, which is considered constant on an interval of one measurement. Variable making is determined by precessions of a sensing element. In conditions of presence of correlated distortion of determined and random character it is necessary with high accuracy to define values of a constant making. This problem is solved in the article because of method of a maximum probability. The realization of algorithm of identification of an angular rule of a sensing element because of artificial neural network application is offered. This network contains a delay line and three adaptive linear neurons. The procedures of training and adaptation of a network provide additional error reduction in non-stationary and unfavorable conditions. The obtained outcomes can be used for a construction of high-precision navigational and gravimetric systems.

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COMPUTATION OF PLANE STRUCTURES EIGENFREQUENCIES BY HYBRID FINITE ELEMENT METHOD USING TREFFTZ FUNCTIONS

A hybrid stress method for eigenfrequencies analysis is developed using a plane rectangular hybrid element. Complex Trefftz functions which are solutions of elastostatic problem are used. By the complementary energy variational equation a relationship between the stress parameters and the nodal displacements is obtained. The Lagrange's variational equation for the dynamic case gives an expression for computation of eigenfrequencies.

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EIGENFREQUENCIES DETERMINATION BY HYBRID STRESS FINITE ELEMENT METHOD

An application of hybrid stress method in studying the free vibrations of two-dimensional continuum in plane stress or plane strain problems by finite elements is investigated. The basis of the method is the assumed parametric stress field giving equilibrium of the internal forces inside the element area. The displacements on the element boundary are independent of the stress field and fully determined by the nodal displacements. The displacement field inside the element is independent of the assumed stress field and it is determined by parameters different than the assumed stress field parameters. Differentiating the assumed displacement field, a new stress field is obtained, which parameters are set to approach the assumed stress field by the least squares method.

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THE ELECTROCHEMICAL CHARACTERISTICS OF SURFACE PRE-TREATED BY ABRASIVE B

The paper presents results of research aimed on evaluation of electrochemical characteristics of metal surfaces after mechanical pretreatment by blasting. Corrosion resistance was evaluated by materials identification at fixed time intervals after their exposure in an electrolyte. Electrochemical characteristics of the blasted surfaces were evaluated in 0.1 mol NaCl solution by electrochemical impedance spectroscopy (EIS). There was used monodispersive blasting media based on different materials in conditions of pneumatic blasting. The results of EIS measurements were a Nyquist diagrams from which there was determined the polarization resistance values R_p on the basis of their circular regression.

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ANALYSIS OF SPOT WELDS QUALITY OF ZINC-COATED SHEETS AND THEIR CORROSIVE PROPERTIES

The contribution presents results of research aimed on evaluation of spot welds quality formed by resistance spot welding at zinc-coated sheets joining processes. There were determined electrochemical properties of materials with help of linear voltammetry. Change of spot weld strength was evaluated before and after their exposure in selected corrosive media.

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PROGRAM CONTROLLED AIR CUSHION ROTARY TABLE WITH PNEUMATIC STREAM DRIVE

Design of the rotary table which uses energy of compressed air to drive necessary movements is proposed in the article. This design increases reconfigurability, performance, and should facilitate to increase in durability due to absence of rigid kinematic connections and dry friction units. Turning angle and stop moment are determined by control program which algorithm is presented in the article. To maximize efficiency of the rotary table it was necessary to study laws of rise of the moving part of the table, its fixation and rotation. Some results of research on time of rise, fixation, rotation, and overall performance of the device are presented in the article.

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THE INFLUENCE OF AMOUNT OF FILLER ON MECHANICAL PROPERTIES FOR ELECTRO PRODUCTS

In order to favorably influence some product manufacture qualities of plastics (an increase of mechanical properties, chemical resistance, etc.), or by reason of reduction in price of finished plastic product, the fillers are added to plastic materials. The contribution deals with the change of mechanical properties of selected types of plastics with different % of glass filler. The mechanical properties were measured by tensile test and Charpy impact test in a standard ambient and after degradation of materials by UV radiance. The fracture areas of studied materials were observed on scanning microscope.

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EVALUATION OF COEFFICIENT OF FRICTION OF UNCOATED AND TIN COATED TOOLS IN DEEP DRAWING

The present investigation was set up to examine both predicted and experimental values of forces, power and friction in drawing cups from low carbon steel blanks using the same die set but in different uncoated and TiN coated conditions. The results showed a good agreement between predicted and experimental values. In addition, the findings demonstrated that the TiN coated tools reduced the friction at a tool – blank – die – interface (by about 5%), which in turn reduced the forces (by about 7%) and improved the final product quality, when compared to the performance of uncoated tools.

MICHAL FABIAN, EMIL SPIŠÁK, JAROSLAV ŠEMINSKÝ, JÁN SLOTA

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THE LATEST ACTUAL TRENDS IN PROCESS OF DESIGN AND PRODUCTION IN AUTOMOTIVE INDUSTRY

Time of innovation cycle in automotive industry is being reduced thanks to increasing market competition. It is possible to follow this trend first of all by means of CA-applications in the design and production phase of product life cycle. Regarding to systematic shortening of design process and manufacturing, the main accent is put on application of CAD/CAM technologies for serial production of shaped-complicated parts. The aim of this paper is to show some aspects of actual trends in process of design and production in automotive industry.

Ivan GAJDOŠ, Peter KAŤUCH

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COMPLEX APPROACH TO THE REVERSE ENGINEERING TECHNIQUES

This paper describes possibilities of integration newest technologies in reverse engineering process. The integration of computer tomography and FDM rapid prototyping technology allows to reproduce plastic parts without any documentation (blueprints, CAD model...) in very short cycles lasting few hours. Even complex shaped parts, with difficult geometry become no problem for combination of these two technologies, where the conventional approach in reverse engineering would last weeks if ever possible. On experimental part with complex geometry was presented modern complex approach in reverse engineering including measuring and digitalizing of part, data preparation for printing, printing and finishing of new part. Computer tomography was also used to compare shape and dimensions of original and reproduced part.

Ivan GAJDOŠ, Ján SLOTA

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IMPROVING SURFACE FINISH QUALITY OF FDM PROTOTYPES

Rapid prototyping technologies decrease production time and costs in engineering industry but also in other industries. One of most widely used technology FDM suffers under low surface finish quality. This paper is aimed on research of surface finishing technologies applicable to improve the quality of FDM prototypes surface finish. Pre-treated samples were blasted with sodium bicarbonate and glass beads. The values of R_a and R_z were measured on the samples and compared the impact of selected blasting medium and blasting conditions on surface finish quality of FDM prototypes.

František GREŠKOVIČ, Eudmila DULEBOVÁ, Ján VARGA

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THE NEW TRENDS IN DESIGN MOULDS FOR PLASTIC

The paper presents new trends and new materials used in the design of moulds for plastics processing. Application of CAD / CAM / CAE systems reduces the time of the design of forming tool. Tool materials produced by new technologies are compared with standard materials. Wear of tool materials were examined for plastics injection molding. Simulation of technology of plastic injection molding process was examined as a tool to improve the quality of plastic parts.

Natalia GRIGORIEVA

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DESIGNING OF TECHNOLOGICAL ASSEMBLY MODULES

The features of construction a modular assembly technology, shaping of modules, designing assembly of technological processes are described. The optimizations approaches for reach of practical construction of modules are shown on a criterion of an amount executed assembly movements.

Mikuláš HAJDUK, Matej ČIRIP, Marek SUKOP

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PLANNING AND CALCULATION OF TRAJECTORY OF HUMANOID ROBOT MOTION

This paper describes the basic principles of kinematic structure design for biped walking robots and also provides a description of planning the movement trajectory for a particular construction of two-legged walking robot. The aim of this work is the creation and description of the principle of mathematical model of biped robot's movement and its correct mathematical interpretation for other using in electronics.

Andrey V. ILCHENKO, Elena V. ZABASHTA, Vladimir A. LOMAKIN

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A FLYWHEEL OF VARIABLE MOMENT OF INERTIA

A new construction of a flywheel of variable moment of inertia of the internal combustion engine is offered.

Daniel JANKURA

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RESEARCH OF THE STRUCTURE AND ADHESIVE PROPERTIES OF CERAMIC COATINGS

The paper presents the research results of adhesive properties of plasma sprayed ceramic coatings on Al_2O_3 and $ZrSiO_4$ base in tribological couples with 19 436 and 12 050 materials and polyamide. Ceramic layers are formed by three types of particles that differ, from each other in form and compactness. Non-compactness in the structure of the layer degrades its properties and it is possible to divide it into voids, pores, branched cracks and large particles. Among the investigated ceramic Al_2O_3 and $ZrSiO_4$ based coatings the Al_2O_3 coating showed the best properties under adhesive wear conditions; this material, mainly in combination with 19436 material, is suitable for friction nodes. The wear value is in accordance with the course of the friction coefficient of the investigated tribological couples. The wear value is connected with the surface hardness of materials in the friction couple. The ceramics-polyamide couple appears to be high-prospective, since it shows a low friction coefficient and minimum wear and seizure tendency.

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JOINING OF STEEL SHEETS FOR AUTOMOTIVE INDUSTRY USING PRESS JOINING METHOD

The paper deals with joining of steel sheets for automotive industry using press joining method. This method is a relatively new technique of car body sheets joining which is beginning to find its place in the automotive industry as an alternative to resistance spot welding, especially in joining materials of different qualities. Combination of two hot-dip galvanized steel sheets: microalloyed steel sheet H220PD of the thickness 0,8 mm and TRIP steel 40/70+Z100MBO of the thickness 0,77 mm were used for the experiments. The tensile test and metalographical analysis were used for evaluation of the press joints properties. The influence of the sheet's position in press joining of used materials on carrying capacity considering the active parts of the tool - punch and die was observed.

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INFLUENCE OF WELDING PARAMETERS OF RESISTANCE SPOT WELDING ON THE QUALITY OF WELDED JOINTS

The paper deals with the influence of welding parameters of resistance spot welding on the quality of welded joints. Joints were made with combination of galvanized steel sheets DX51D + Z (EN 10142/2000) and TRIP 40/70+Z100MBO. It is an advanced material combination frequently used in designing car body parts. For evaluation of joints quality the shear tension test on spot joints according to DIN 50 124 standard was used. The basic mechanical properties of welded joints were evaluated. Some samples were prepared for metallographic analysis where the influence of the welding parameters on the structure of welded joint was observed. We also observed the influence of welding parameters on the dimensions of the weld nugget, as well as the occurrence of pores in the weld metal caused by evaporation of zinc from the coating. Hardness was evaluated on metallographic scratch patterns according to STN EN 1043-2 standard.

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THE CAUSES OF FAILURES IN RESISTANCE SPOT WELDING OF CAR BODY SHEETS

The paper deals with analyzing of defects of resistance spot welds, which mostly occur in welding of materials used in car body production. The defects were evaluated with destructive and non-destructive tests. A non-destructive method was a visual control of weld surfaces of lapped joints. Metallographical analysis of weld joints on scratch patterns was used as a destructive method. The Influence of welding parameters on dimensions of weld nuggets was observed with light microscopy. The defects in weld and heat affected zone were documented too. The influence of surface treatment of car body sheets on occurring of defects was evaluated with chemical EDX analysis. EDX analysis was also used for evaluation of weld joints surfaces and for evaluation of influence of weld tips marks on surface quality.

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SYSTEM ANALYSIS OF SURFACING AT INTENSIVE PROCESSING AND USING OF DETAILS

The research results of technological mediums with different physical-chemical properties are discussed. Combined processing methods, using different sources and uniting different operations and stages, are shown. Basic controlling statements of surfacing and using of details are defined.

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ANALYSIS OF ENERGETIC PARAMETERS OF JOHN DEERE 6620 AGRICULTURAL TRACTORS

Measurement of energetic parameters is one of the most important factors enabling efficient exploitation of agricultural tractors. Knowledge of these parameters is necessary for assessment of vehicle work economics but also enables determination of its present technical condition. Goal of this work was determination of energetic parameters of John Deere 6620 agricultural tractors. Courses of external characteristics of torque M_{oz} , power N_{ez} , hourly G_c and unitary fuel consumption g_{ez} were determined. Research concerned tractors equipped with straight 6 cylinder engine powered by dispenser supply system or by distributor injection pump with turbocharger and intercooler. Tractor engine energetic parameters obtained as a result of such investigations enable evaluation of energetic "saturation" of a tractor. Mainly its energy consumption and ability to work in changing work conditions including changes of load and rotation speed.