Summaries

UDC 514.76

Ivlev E.T., Glazyrina E.D.
THE VARIETY OF LINES IN MULTIDIMENSIONAL EUCLID'S SPACE

The fields of invariant geometric images on m-family of straight lines in Euclid's space E_n ($n \geq 2m+1$) determining by fundamental geometric object components, have been studied analytically and geometrically.

UDC 514.76

Ivlev E.T., Glazyrina E.D.
THE FIELDS OF TWO-DIMENSIONAL AREAS OF STRAIGHT LINE VARIETY IN MULTIDIMENSIONAL EUCLID'S SPACE

Two fields of invariant two-dimensional areas have been determined analytically and geometrically at m-dimensional variety G_m^1 of straight lines l_1^n in n-dimensional Euclid's space E_n ($m>2$, $n \geq 2m+1$).

UDC 517.54

Ber L.M.
DISTORTION THEOREM STRENGTHENING

The estimations generalizing G.M. Goluzin theorems on chord distortion have been obtained for schlicht functions with symmetry of rotation.

UDC 681.5:330.43

Kochegurov V.A., Konstantinova L.I., Galchenko V.G.
ENGINEERING ECONOMETRICS IN PROBLEMS OF SYSTEM ANALYSIS

The issues of quantitative system analysis have been considered similarly to econometrics. In this case the object is represented in the form of abstract model without reference to concrete field subject to the feature of their mathematical description. The notion of system units characterizing properties of dynamic objects is introduced; physical substantiation is given and analogy with measuring units in subject fields is determined.

UDC 621.01:519.242

Yanushevskis A.V., Melnikov A.G., Kaktabulis I.D.
THE TECHNIQUE OF OPTIMIZING THE MECHANICAL SYSTEM ELEMENT SHAPE

A resource-saving technique for optimizing element shape of the mechanical system developed by means of CAD has been proposed. The procedure includes planning of location of the polygon control points of non-uniform rational B-splines that define the shape as well as building the metamodels used further for optimization. The efficiency of the technique is shown by solution of a test problem as well as for the shape optimization of the disk for mounting of measurement equipment on the axle of wagon wheel pair. The obtained shapes and appropriate quantitative indices are given.

UDC 62–752.8

Pozdeev L.V., Mikhaylov A.G., Timoshenko V.A.
THE INFLUENCE OF MODIFYING OF TWO-CASCADE DAMPING FASTENINGS DESIGN ON VIBRATION ACTIVITY OF CENTRIFUGAL SHIP ELECTROFANS

The efficiency of modification of a two-cascade damping mount design of centrifugal fan for decreasing the vibration level has been shown. Using the software package of modal analysis ME'scopeVES the finite-elemental model of the intermediate frame which adequacy has been confirmed experimentally was received. The advanced design of the intermediate frame was offered.

UDC 539.375

Solyanik A.S., Morozov M.N., Zhdanova A.O.
DEFORMATION CONDITIONS OF CRACK INITIATION IN FLAT BODIES WITH CONCENTRATORS

The experimental results of the tested flat samples with a circular hole of three plastic metals – steel, aluminum, brass have been introduced. Using the grade grid method the ultimate strain preceding crack appearance in a weak section on concentrator circuit was estimated. The dependence of ultimate strain on the relative deformation gradient was determined, analytical functions describing this dependence were selected. Practical recommendations for estimating the deformation level on concentrator circuit in the weak section by a relative change of its sizes were given.

UDC 621.787

Skvortsov V.F., Okhotin I.S.
PLASTIC REGION RADIUS AT HOLE MANDRELLING IN THICK-WALLED CYLINDERS

It was shown that plastic region radius at hole mandrelling in hollow cylinders made from materials with linear hardening does not depend on the thickness of their walls and may be determined by the reduced formula.

UDC 621.9.02

Kuznetsov V.P., Dmitrieva O.V.
MODELING AND STUDYING THE FORMATION OF FLAT-TOPPED MICRO RELIEF OF FRICTION SURFACE WITH OIL MICROPOCKETS AT MULTIPURPOSE PART PROCESSING

The issues of forming micro relief of friction surface of high-precision parts with high performance properties at multistage finishing treatment at turn-milling centers have been considered. The laws of controlling the volume of the obtained oil micropockets were determined on the basis of modeling the strain profiling modes.

UDC 621.787.4

Kuznetsov V.P., Dmitrieva O.V., Makarov A.V., Kiryakov A.E.
EXPERIMENTAL AND THEORETICAL RESEARCHES OF FORMING SUB-MICRO-ROUGH DETAIL SURFACES BY BURNISHING AT TURN-MILLING CENTERS

The formation of sub-micro-rough profile of detail surfaces from corrosion-resistant steel in various structural conditions at finishing treatment by burnishing with the instrument with elastic damper at turn-milling centers has been studied. The mathematical model of burnishing force specified for forming sub-micro-rough profile of the treated surface was proposed.

UDC 621.923

Smirnov V.A.
SOLUTION OF THERMAL PROBLEM AT GRINDING SUBJECT TO HEAT FLOW INTERMITTENCE

The solution of nonsteady nonlinear two-dimensional heat conduction equation at flat grinding of circle periphery subject to heat flow intermittence has been introduced. It was proposed to represent heat flow in a contact zone of grinding wheel and a workpiece in the form of a sum of distributed and pulse parts. The obtained results allow predicting workpiece temperature change at grinding.

UDC 539.375

Panin S.V., Yussif S.K., Ovechkin B.B., Sergeev V.P., Vlasov I.V., Panin V.E.
THE PROBLEMS OF DESTRUCTION OF CASE-HARDENED MATERIALS WITH DIFFERENT GEOMETRY OF CONTACT «COATING-BASE»

Different variants of implementing multiple cracking concept, supporting the possibility of increasing destruction resistance of compositions «coating-base», have been demonstrated experimentally by the example of various coating methods. Optical-television measuring system TOMSC, was used for studying the specific character of their deformation behavior as well as traditional methods of optical and electronic microscopy. It was shown that the type of multiple cracking may influence considerably on mechanical characteristics of material with coating. The variation of structural heterogeneity (teeth) parameters of ceramic coating was carried out within the frames of theoretical investigations for controlling the character of its cracking. Comparing experimental and theoretical results the relation between the formation of interface non-planar profile, change of stress strain state, laws of crack occurrence and multiple cracking was observed.

UDC 621.891

Gritsenko B.P., Krukovsky K.V., Girsova N.V.
THE INFLUENCE OF ACOUSTIC VIBRATIONS GENERATED AT FRICTION ON TITANIC ALLOY WEAR

The researches of titanic alloy wear under conditions of dampening acoustic vibration occurring at fraction have been introduced. It was shown that acoustic vibrations are similar to additional effective load by their action. The acoustic vibration damping in tribosystem may influence the wear mechanism and decrease titanic alloy wear.

UDC 620.179.16

Kolubaev E.A., Sizova O.V., Pupynin S.A.
THE FEATURES OF ACOUSTIC EMISSION AT HADFIELD STEEL FRICTION

The relation between acoustic emission signal parameters and the character of Hadfield steel friction (H13) has been studied. The correlation between the acoustic emission spectrum and friction coefficient was determined. The mechanism of acoustic vibration excitation owing to structure degradation of friction surface was proposed.

UDC 621.039.5:004.942

Shamanin I.V., Gavrilov P.M., Bedenko S.V., Martynov V.V., Pavlyuk A.O., Lyzko V.A.
THE DYNAMIC OF ACCUMULATION AND DECAY OF INDUCED ACTIVITY IN THE ELEMENTS OF CONTAINER CONSTRUCTION AT IRRADIATED NUCLEAR FUEL STORAGE

The design analysis of spectral and integral characteristics of radiation fields close to transport container intended for transporting and long-term storage of irradiated fuel of the reactor RBMK-1000 has been carried out. The dynamic of accumulation and decay of material radioactivity induced in the course of operation was studied. These materials are used for making container construction elements. The obtained information on composition and characteristics of the induced and accumulated radioactivity allow developing the data base intended for recovering the history and conditions of operating the radiation-dangerous objects which will be finally reconstructed or taken out of service.

UDC 621.039.517.5

Golovatsky A.V., Nesterov V.N., Shamanin I.V.
OPTIMAL OPERATING TEMPERATURE OF GRAPHITE FOR SUPPORTING TARGET BURN-UP DEPTH OF NUCLEAR FUEL IN THE REACTOR GT-MGR

The technique of determining optimal operating temperature of graphite in the reactors GT-MGR for supporting design values of nuclear fuel burn-up depth and fuel block service life has been stated. Allocations of graphite used resource were defined subject to irregularity of energy release along the active zone height for uranium-plutonium and thorium-uranium nuclear fuel cycles. The dependences of fuel block graphite service life on the values of heat liberation and operation temperature were obtained.

UDC 537.862

Grigoryev V.P., Zherlitsyn A.G., Koval T.V., Melnikov G.V., Marchenko A.L., Ngouen Tuan Min
STUDYING THE STRUCTURE OF FIELDS AND RESONANCE FREQUENCIES OF PLANAR-COAXIAL REFLECTING TRIODE

Numerical investigation of field and resonance frequency structures in planar-coaxial electrodynamic system of reflecting triode has been carried out. It was shown that axially symmetric wave E_{01}, non-symmetrical waves H_{11} and H_{21}, as well as TEM mode in non simply connected area which is transformed into the wave E_{01} in cylindrical triode area, may be excited in planar-coaxial triode with virtual cathode.

UDC 537.333

Grigoryev V.P., Vagin E.S., Ofitserov V.V.
STUDYING THE CHARGE AND CURRENT NEUTRALIZATION OF LOW-ENERGY HIGH CURRENT ELECTRON BEAM IN EXTERNAL MAGNETIC FIELD AT PLASMA INJECTION

The problem of simulating the process of electron beam transportation in the chamber filled up with low pressure plasma subject to the current and charge beam neutralization has been considered. The description of numerical model developed in MatLab environment was introduced. The simulation results were given.

UDC 681.31:533.95

Grigoryev V.P., Zvigintsev I.L.
THE MODEL OF PLASMA MODEL FORMATION BY LOW-ENERGY BEAM IN LOW PRESSURE ARGON

The model of plasma channel formation at transportation of low-energy high current electron beam in low pressure argon has been introduced. Ionization processes in conditions of complete and incomplete charge beam neutralizations at imposition of strong external magnetic field were examined. Times of complete charge beam neu-

tralization were computed. Plasma current dependence on pulse current time at the front and back edges of injected beam was determined.

UDC 621.791

Poletika I.M., Krylova T.A., Makarov S.A.
USING ELECTRON-BEAM TREATMENT FOR DEVELOPING HARDSURFACING OVERLAYS

Chrome-containing coatings on low-carbon steel with ultradispersed and nano-scale structures possessing high hardness and wear resistance have been obtained by surfacing method in relativistic electron beam and further pulse treatment by low-energy electron beam. Diagrams «loading-unloading» of several types were detected at nanoindentation.

UDC 539.424:539.534.9

Sergeev O.V., Fedorishcheva M.V., Sergeev V.P., Popova N.A., Kozlov E.V.
CHANGING MECHANICAL PROPERTIES OF MARAGING STEELS AT ION-BEAM NANOSTRUCTURING OF SURFACE LAYER

The change of strength and plastic properties of maraging steel EI122 at surface layer nanostructuring by ion beams (Al+B) has been studied. The effect of plasticity and strength simultaneous increase was ascertained. Its size depends on original and post-implantation sample thermal treatment and radiation level. Structural-phase state of surface layer of original steels and those nanostructured by ion beam was studied by the methods of transmission electron microscopy and X-ray-structural analysis. Mechanisms of the observed effect were discussed on the basis of the obtained results.

UDC 539.231:536.495:621.785

Sergeev V.P., Fedorishcheva M.V., Sungatulin A.R., Nikalin A.Yu., Neyfeld V.V
STRUCTURE AND THERMOMECHANICAL PROPERTIES OF SURFACES ON THE BASIS OF SI–AL–N AT THEIR PRECIPITATION BY PULSE MAGNETRON SPUTTERING METHOD

Coatings on the basis of Si–Al–N have been obtained by magnetron sputtering method. Their structure and phase composition were studied by the methods of atomic force microscopy and X-ray-structural analysis. The influence of coating precipitation modes on their thermal-cycle resistance was found out.

UDC 533.9;538.9

Gostishchev E.A., Surmenev R.A., Khlusov I.A., Pichugin V.F.
STUDYING BIOELECTRIC COMPATIBILITY OF THIN CALCIUM-PHOSPHATE COATINGS OBTAINED BY HIGH-FREQUENCY MAGNETRON SPUTTERING METHOD

Problems of estimating the criteria of bioelectric compatibility of medical implants have been discussed. The results of determining surface charge density of biocompatible calcium-phosphate coatings by plunge electrode method, supporting the measure of electric field potentials of weakly charged surfaces in conditions of environmental electrostatic actions exceeding multiply the measured potential level, were provided. Using model postulates of the design theory of electrets electric fields the quantitative estimation of electric field in calcium-phosphate coating growing in magnetron discharge plasma was carried out. The technique and calculation of electrostatic field at the interface of biological tissue with the coating surface were introduced. On the basis of comparative analysis of the efficient electric field characteristics on cellular level of living body biological organization it was shown that CaP coatings are bioelectrically compatible.

UDC 538.911

Klopotov, V.D. Klopotov A.A., Potekaev A.I., Gyunter V.E., Yasenchuk Yu.F., Jalolov Sh.A., Marchenko E.S., Kozlov E.V.
PHYSICAL-CHEMICAL APPROACHES TO THE CHOICE OF ADDITION ELEMENTS IN THREE-PART ALLOYS WITH THE SHAPE MEMORY EFFECTS ON TITANIUM NICKELID BASE. I. ADDITION ELEMENT – METALS OF IVA–VA GROUPS

On the basis of systematization of state diagrams Ti-Ni-Me (Me – addition element) it was ascertained that extended homogeneity areas of compounds on the basis of TiNi (Me) with B2 structure were observed in those systems which mean group number magnitudes determined as an element electron number out of proper inert gas shell are close to 7 el/at. On the basis of analyzing scientific data, crystal-chemical factors and morphology of homogeneity areas arrangement on the state diagrams Ti-Ni-Me the addition element atom arrangement at nickel and titanium sublattices in crystal lattice nodes in B2 structure were analyzed.

UDC 538.911

Klopotov V.D., Klopotov A.A., Potekaev A.I., Gyunter V.E., Yasenchuk Yu.F., Jalolov Sh.A., Marchenko E.S., Kozlov E.V.
PHYSICAL-CHEMICAL APPROACHES TO THE CHOICE OF ADDITION ELEMENTS IN THREE-PART ALLOYS WITH THE SHAPE MEMORY EFFECTS ON TITANIUM NICKELID BASE. II. ADDITION ELEMENT – METALS OF VIA–VIIIA, IB AND IIIB GROUPS

Ternary state diagrams Ti-Ni-Me (Me – addition element) have been arranged and general law: extended homogeneity areas of compounds on the basis of TiNi (Me) with B2 structure were observed in the systems which mean group number magnitudes determined as an element electron number out of proper inert gas shell are close to 7 el/at, has been determined. On the basis of analyzing scientific data, crystal-chemical factors and morphology of homogeneity areas arrangement on the state diagrams Ti-Ni-Me the dependences in addition element atom arrangement at nickel and titanium sublattices in crystal lattice nodes in B2 structure were studied.

UDC 533.9

Medvedev V.V.
EROSION TORCH ELECTRIC CONDUCTIVITY AT LASER PULSE ACTION ON MATERIALS CONTAINING NANODISPERSED CARBON

Erosion torch electric conductivity at a distance of 5 mm from end surface of dibasic fuel and magnesium oxide with different content of nanodispersed carbon (lamp black) has been experimentally examined. Laser radiation impacted with pulse length of 0,5 ms, wave length 1,06 μm and energy density to 20 J/cm^2. The experiments were carried out in the air at standard conditions. Introducing lamp black into the samples the precise correlation between erosion torch electrical conductivity and carbon particle content in the target was observed. The experimentally observed phenomena were interpreted.

UDC 539.194;535.621

Bykov A.D., Emelyanov D.S., Stroynova V.N., Tyurin Yu.I.
TEMPERATURE DEPENDENCE OF RELAXATION PARAMETERS OF DIATOMIC MOLECULE SPECTRAL LINES

The calculation results of temperature dependence of half-widths and center shifts of CO, HF molecule lines in atmospheric pressure plasma have been introduced. Theoretical model including the correct description of intramolecular dynamics in highly excited vibrational states was used. The computations were carried out by RELAX software system.

UDC 538.953;53.092;539.63

Lisitsyn V.M., Zhuravlev Yu.N.

FIRST PRINCIPLE INVESTIGATIONS OF VIBRATIONAL STRUCTURE AND THERMODYNAMIC FUNCTIONS OF SILVER AZIDE

The dependences of total energy, pressure and frequencies of long-wave vibrations on balanced unit cell volume have been computed by the method of atomic orbital linear combination with exchange-correlation potential gradient approximation of electron density functional theory of CRYSTAL09 software package. Thermodynamic functions of internal energy, free energy, free enthalpy, enthalpy, entropy and heat capacity as well as Grüneisen thermodynamic parameter were determined on this base. It was shown that average vibration frequency increases at pressure growth that results in increase of internal and free energies and enthalpies, decrease of entropy and heat capacity. Grüneisen parameter for balanced volume equals ~1,6 and it decreases at pressure growth; thermal pressure changes in its turn in the range of 2...3 GPa. The combination of the applied techniques and the obtained results represents the implementation of first principle method for constructing thermal equation of silver azide state.

UDC 621.315.61

Merkulov V.I., Karpitsky O.V.

THE FEATURES OF DISCHARGE DEVELOPMENT ON THE INTERFACE OF SOLID LAYERED DIELECTRICS AT LONG-TERM EFFECT OF THE APPLIED VOLTAGE

Charge development on the interface of solid layered composite dielectrics owing to exposure time of the applied alternating voltage in the system of electrodes generating nonuniform electric field has been developed. The presence of three stages in discharge development on the interface of the examined layered composite dielectrics depending on voltage application time was determined.

UDC 622

Isaenko A.V., Rifel M.F.

DEPENDENCE OF COMPRESSION PROPERTIES OF SLAG-LIMEY AUTOCLAVE MATERIALS ON DURATION OF VAPOR PRESSURE BUILD UP

The methods of vertical mine working backfill and ecological consequences of their incorrect backfill have been analyzed. The necessity of developing the technique of vertical mine working backfill by hardening concrete mixes on the basis of fuel and energy complex wastes was substantiated. The results of preliminary surveys for determining compression properties of autoclave materials consisting of TPP ground slag, lime and water, were introduced. The dependences of compression of slag-limey backfill materials on vapor rise duration were given.

UDC 551.32

Ostrovskaya G.V.

RODE OF LIFE OF PROFESSOR B.P. VEYNBERG AND HIS ICE MOUNTAIN. ON THE 140TH ANNIVERSARY OF B.P. VEYNBERG AND THE 70TH ANNIVERSARY OF THE ROAD OF LIFE

The article is devoted to two jubilees: 140th anniversary of professor of Tomsk Technological Institute B.P. Veynberg and 70th anniversary of the opening of the motion down the famous Road of Life. The main works of B.P. Veynberg in the field of glaciology were noticed; the information on his participation in the project of the Road of Life and on the mountain in Antarctic named after Veynberg were introduced.