Summaries

UDC 514.76

Ivlev E.T., Luchinin A.A., Moldavanova E.A.
CAUCHY–RIEMANN CLASSIFICATION
OF MULTIDIMENSIONAL SURFACES IN EUCLIDEAN SPACE

The authors study the particular classes of multidimensional surfaces in Euclidean space characterized by a special type of Cauchy-Riemann mapping of two-dimensional areas of tangent and normal bundles determined in previous works.

UDC 514.76

Ivlev E.T., Luchinin A.A., Moldavanova E.A.
PROPERTIES OF CAUCHY–RIEMANN SURFACES
IN MULTIDIMENSIONAL EUCLIDEAN SPACE

The authors study geometric properties of Cauchy-Riemann multidimensional surfaces in Euclidean space determined in [1]. The induced connectivities in tangent and normal bundles of the given surfaces are invoked for this purpose.

UDC 517.956

Moldoyarov U.D.
NON–LOCAL PROBLEM WITH INTEGRAL CONDITIONS
FOR NON–LINEAR EQUATION IN PARTIAL DERIVATIVES
OF THE THIRD ORDER

The method of integral equations and contraction mapping proved the unique perm solvability of a nonlocal problem with integral conditions for a nonlinear partial differential equation of the third order.

UDC 519.63

Zimin V.P.
THE DEVELOPMENT OF THE PHASE PLANE METHOD
FOR ANALYZING THE SOLUTIONS
OF BOUNDARY VALUE PROBLEMS

The author proposes the development of the phase plane method for analyzing the solutions of boundary value problems for differential equations with partial derivatives. Such analysis is required at the stages of algorithmization of nonlinear boundary value problems and models verification. The author substantiates the selection of phase planes for analyzing the solutions of boundary value problem on distribution of low-temperature plasma parameters in thermionic converter.

UDC 621.83:621.81.002.2

Kobza E.E., Efremenkov E.A., Demidov V.N.
THE ANALYSIS OF CYCLOID DRIVE FORCE DISTRIBUTION
CONSIDERING LINK MANUFACTURING TOLERANCES

The article introduces the analysis of force distribution of the drive with intermediate rolling elements and freewheel cage considering errors in manufacturing wheels with cycloid profile and rolling elements. The authors have determined the dependence of changing force on accuracy at manufacturing drive parts as well as the number of rolling elements non-participating in force transmission because of manufacturing tolerances. The dependences defining the angle at which the rolling element contact with cycloid wheel profile is interrupted have been plotted.

UDC 62−231

Cheremnov A.V., An I–Kan, Ivkina O.P.
SYNTHESIS OF SPACE GEAR WITH INTERMEDIATE
ROLLING ELEMENTS WITH THE ADVANCED
QUALITATIVE CHARACTERISTICS

The authors have determined the reasons of redundant constraint occurrence in gears with intermediate rolling elements. The article demonstrates the possibility of developing the mechanical gear possessing high efficiency based on the gear with intermediate rolling elements.

UDC 531.717+681.2.083

Zaytsev E.S., Domnenko A.I., Astafurov V.G.
DETERMINING ROTOR RADIAL RUN–OUT
BY THE ROTATION SENSOR SIGNAL

The authors propose the model of sensor inductor rotation in a permanent magnet field. On the basis of this model the techniques for determining rotor radial run-out (vibration) have been developed. These methods differ in the result accuracy, the mathematical tool complexity and possibilities of application in the systems with different computational power. The techniques proposed may be applied for controlling mechanical condition of rotary machines by the run-out dimension using rotation sensors being a part of equipment.

UDC 620.179.13

Kurilenko G.A.
FORECASTING THE CYCLE LIFE OF COMPONENTS WITH
MACROCRACKS BY THE THERMOGRAPHIC METHOD

The author has developed the method for forecasting cycle life of the components with macrocracks based on thermographic effect of damaging accumulation, specific entropy increment on the top of the growing crack. The method allows increasing forecasting accuracy in comparison with the technique using Paris formula. The accuracy increase is achieved by using true characteristics of damaging development obtained by observation of the object under investigation instead of probabilistic ones. The range of components for forecasting extends as entropy is calculated by temperature change at the component surface close to crack top. There is no necessity to observe crack growth.

UDC 535.36

Goryachev B.V., Mogilnitsky S.B.
THE EFFECT OF REFLECTIVE SURFACE ON DISPERSION
MEDIA RADIATION BALANCE

The article considers the radiation transfer in dispersion media limited by reflective surfaces. It is shown that the reflective and absorptive capacities of the system dispersion medium-reflective surface do not depend on surface reflection coefficient when achieving certain value of the medium optical density. The authors have studied the effect of the reflective surface position on the absorptive capacity of the similar system.

UDC 621.039.51

Prozorova I.V.
THE WAYS FOR MODERNIZATION OF CHANNEL–TYPE
RESEARCH REACTOR IVG.1M

The author considers the ways of converting the reactor IVG.1M to the low-enriched fuel. The article introduces the results of estimation of the main core neutronic parameters in the updated reactor IVG.1M. The conclusion is made that uranium-zirconia fuel elements with uranium high concentration in the core and Zr-^{235}U enrichment to 20 % may be used as a new type of fuel.

UDC 616−089.165.5−089.43:549.212−022.532

Rostov V.V., Alekseenko P.I., Vykhodtsev P.V.,
Steinle A.V., Mazin V.I., Krasnozhyonov E.P.,
Mushtovatova L.S., Solodkova T.V., Postnikov P.S.,
Kutonova K.V., Steinle L.A., Shatokhin A.A.
HIGH–CURRENT PULSED–PERIODIC ELECTRON
ACCELERATOR OF DIRECT ACTION AS A POSSIBLE MEANS
FOR STERILIZATION OF MEDICAL ITEMS

The object investigated by the authors is searching for the safe and economical graphite-based adsorbent dressing sterilization method. The created high-current impulse-periodic electronic accelerator of direct action with accelerated electron beam lead-out in the atmosphere allows sterilizing the new adsorbent dressing. Material and analysis: bacteriolog-

ical studies have been used to check the sterility of the dressing; receptivity and adsorptivity of the adsorbent dressing before and after sterilization, the influence of sterilization to receptivity and adsorptivity have been also studied. Conclusion: to guarantee the full graphite-based adsorbent dressing sterilization it is necessary to use not less than 25 impulses of electron beam raying. The summarized absorbed dozes are: D=17 kGy for a Spanlase-based dressing, D=13 kGy for a dressing based on decalcified filter. The both dozes are lower than analogous ones in application of ?-raying bandage sterilization. Receptivity and adsorptivity of the adsorbent dressing after sterilization have not changed.

UDC 621.039.342.001.53

Orlov A.A., Sovach V.P.
OBTAINING ENRICHED ^{13}C IN GAS CENTRIFUGE CASCADE USING ISOTOPE EXCHANGE IN CARBON DIOXIDE

The article considers the possible schemes of isotope exchange in the carbon dioxide in the isotope exchange reactor. Changes in molecular spectrum of carbon dioxide and distribution of ^{13}C isotope at the inlet and outlet of the reactor are shown. The authors have studied the dependence of operation efficiency of gas centrifuge cascade for obtaining highly enriched ^{13}C on the isotope exchange reactor installation at different values of isotope exchange degree. It is shown that the function of the cascade operation efficiency represents the unimodal convex line with maximum. Places of optimal location for one or two isotope exchange reactors in a gas centrifuge cascade and the values of isotope exchange in them at which more than 99 % enrichment in ^{13}C can be achieved are determined.

UDC 533.9.08

Kazaryan M.A., Morozova E.A., Plyaka P.S.
THE OPPORTUNITIES OF LASER METHODS FOR RESEARCHING MICROPARTICLE DYNAMICS IN PLASMA

The authors discuss the possible mechanisms of laser radiation effect on nano- and microparticles in plasma and propose the combined method for researching particle dynamics. The article describes the experimental unit for investigating nanoparticles distribution in discharge plasma and introduces the preliminary results.

UDC 519.245:543.427.4

Berlizov A.N., Boyko V.I., Sharikov D.A., Sarli F., P. Van Belle, Ottmar Kh., Lyutzenkirchen K.
MODELING SPECTRA OF ENERGY–DISPERSIVE X–RAY FLUORESCENCE MEASUREMENTS OF ACTINIDES BASED ON MONTE–CARLO METHOD

The article introduces the main principles of modeling the experimental spectra of energy-dispersive X-ray fluorescence measurements made by a hybrid densitometer by K-absorption edge. The authors present the testing results of the simulated approach for a set of certified actinide solutions (thorium and uranium-plutonium samples). The quantitative analysis of these solutions is carried out in analytical laboratories of radiochemical enterprises.

UDC 620.179.15

Udod V.A., Solodushkin V.I., Klimenov V.A., Temnik A.K.
ESTIMATING THE EFFICIENCY OF USING DETECTORS WITH INHOMOGENEOUS SPATIAL SENSITIVITY IN SCANNING SYSTEMS OF DIGITAL RADIOGRAPHY

The authors have solved the problem of optimal selection of aperture length and inhomogeneity parameter for spatial sensitivity in one single detector from the line, radiation recording time and impulse response of digital filter for the scanning systems of digital radiography containing the line of detectors with inhomogeneous (exponential) spatial sensitivity in scanning direction. The maximum of the system spatial resolution in scanning direction served as the criterion of optimality. The efficiency of using the detectors with inhomogeneous (exponential) sensitivity in these systems was estimated by the results of optimization problem solution.

UDC 535.21

Kanev F.Yu., Tsyro E.I., Makenova N.A., Kuksenok D.S., Antipov O.L.
PROPAGATION OF RADIATION GENERATED BY MULTICHANNEL LASER SYSTEM WITH COHERENT ADDITION IN ATMOSPHERE. P. 1. FREE DIFFRACTION CONDITIONS

The current investigations of multichannel laser systems with coherent radiation addition have been analyzed. The authors enumerated the confounding factors, described the techniques of their active and passive compensation. The article introduces the results of modeling the complex profile beams propagation in free diffraction conditions. The influence of a number and geometry of radiating aperture arrangement on energy transfer efficiency has been considered.

UDC 535.21

Kanev F.Yu., Tsyro E.I., Makenova N.A., Kuksenok D.S., Antipov O.L.
PROPAGATION OF RADIATION GENERATED BY MULTICHANNEL LASER SYSTEM WITH COHERENT ADDITION IN ATMOSPHERE. P. 2. THE EFFECT OF DISTORTIONS AND THEIR COMPENSATION

Energy transfer by multichannel optical system has been investigated. The authors studied the effect of random phase incursions and atmospheric turbulence on light field parameters in focusing plane and considered the possibility of using the multidither algorithm for correcting random phase distortions occurring in multichannel system.

UDC 537.862

Zherlitsyn A.G., Koval T.V., Kanaev G.G., Nguen T.M.
STUDYING THE GENERATION OF ELECTROMAGNETIC EMISSION IN COAXIAL VIRCATOR WITH A DIVERGENT BEAM

The article introduces the results of the experimental and theoretical researches of the coaxial vircator of microwave radiation with a symmetrical radiate divergent beam. The authors have investigated the influence of system geometry and beam parameters on virtual cathode formation and radiation characteristics. The theoretical research was carried out by the coarse particle technique applying the numerical modeling. The dependences of current, frequency characteristics, radiation power on beam geometry and parameters were obtained. The radiation power with narrow antenna pattern with the power to 300 MW on a frequency of 3 GHz was obtained by the experiment.

UDC 621.791

Poletika I.M., Makarov S.A., Tetyutskaya M.V., Krylova T.A.
ELECTRON–BEAM WELDING OF WEAR AND CORROSION RESISTANT COVERINGS TO LOW–CARBON STEEL

Wear and corrosion resistant coverings are obtained by the electron-beam welding technique at accelerator of electrons of chrome and boron carbide powder blends in the ratio 3:1 and at radiation parameter change. Based on the research of the coverings structure and phase composition the authors studied the nature of formation of these properties.

UDC 539.534.9. 539.538

Sungatulin A.R., Sergeev V.P., Fedorishcheva M.V., Sergeev O.V., Popova N.A.
STRUCTURE AND WEAR RESISTANCE OF 38HN3MFA STEEL MODIFIED BY (CR+B)$^+$ ION BEAMS

The authors have studied the change in structural-phase state and elements propagation in surface layer of 38HN3MFA steel at implantation with (Cr+B) ion beams as well as the change of wear resistance and hardness when operating in friction couple «38HN3MFA steel-PA-66 polyamide». The improvement of steel tribomechanical properties was found out at surface layer modification by a composite ion beam which is connected with the change in structural-phase state of this layer.

UDC 621.791.14

Gnyusov S.F., Orishich A.M.
STRUCTURAL–PHASE STATE AND MECHANICAL
PROPERTIES OF WELD JOINTS AT LASER WELDING
OF TITANIUM AND STAINLESS STEEL

The authors have studied the weld joints «titanium−titanium» and «titanium−12H18N10T steel» obtained by using laser radiation. The structure of the weld joint of titanium alloy VT1−0 has two typical morphological features: β-phase with coarse polyhedral grains and α-phase with laminar nature of intragranular structure. The material ruptures by the main metal and this rapture is of viscous character. When welding titanium alloy with austenitic stainless steels through the copper interlayer the intermediate layer based on intermetallic phases with the thickness 100...150 μm is formed on the side of titanium alloy.

UDC 621.791.92

Gnyusov S.F., Makov D.A.
THE EFFECT OF AGEING CONDITIONS ON EVOLUTION
OF STRUCTURAL–PHASE COMPOSITION AND PROPERTIES
OF COMPOSITION COATINGS

The authors have studied the effect of thermal treatment on structural-phase composition and properties of austenitic composition coatings covered by electron beam facing. The rational ageing conditions supporting the saving of matrix austenitic structure and equal multimodal size distribution of carbide phase in the hardened layer volume was determined. It is possible to form such structural-phase state of the composition coating at alignment of vacuum electron beam facing and thermal treatment.

UDC 669.295.5:539.62

Potekaev A.I., Khokhlov V.A., Galsanov S.V.
THE NATURE AND MECHANISMS OF ABRASIVE WEAR
OF THE MATERIALS WITH SHAPE MEMORY
BY THE EXAMPLE OF TITANIUM NICKELIDE

Considering motion scheme over the surface of titanium nickelide with friction of indenter imitating abrasive grain it has been ascertained that the predominant mechanism of abrasive wear is the material repeated plastic deformation and as a result its surface fatigue failure at certain force and speed conditions. The anomalously high wear resistance may be explained from the position of direct and reverse martensitic transformations which suppress the formation of damages encouraging micro- and macrofractures on a microlevel.

UDC 669.295.5:539.62

Khokhlov V.A., Potekaev A.I.,
Tabachenko A.N., Galsanov S.V.
STUDYING THE TRIBOLOGICAL PROPERTIES
OF TITANIUM NICKELIDE

The authors have studied the effect of slide rates and pressures on wear intensity, temperature in contact zone and friction coefficients. It is shown that titanium nickelide wear resistance is much more higher than that of classical wear-resistant materials. The wear mechanisms and the nature of anomalously high wear resistance have been determined from the position of martensitic transformations. The intervals of rate and pressure change in which the wear changes from the steady state to the extremely gross one were defined. These results allow selecting their optimal values at friction joint design.

UDC 62−752.6

Gavrilin A.N., Sikora E.A., Angatkina O.O., Rozhkov P.S.
MATHEMATICAL MODEL OF THE VIBRATION
FRICTION–TYPE DAMPER FOR PROCESSING
PARTS OF ROTATION BODY TYPE

The authors have made and studied the dynamic model of the vibration friction-type damper which allows selecting optimal inertia dissipative elastic parameters of the vibration damper decreasing the vibration level of the protected object.

UDC 681.52

Verozubova G.A., Filippov M.M., Gribenyukov A.I.,
Trofimov A.Yu., Okunev A.O., Stashchenko V.A.
STUDYING THE EVOLUTION OF STRUCTURAL DEFECTS
IN MONO CRYSTALS ZnGeP$_2$ GROWN BY
THE BRIDGMAN METHOD

The article introduces the results of research of structural defects in mono crystal ZnGeP$_2$ grown by the Bridgman method in vertical version. The longitudinal section and three cross sections of mono crystal are studied by the X-ray topography method based on Bormann effect. The difference in defect structures in initial, middle and end parts of the crystal are found out. The article introduces numerical estimates of crystallization front behavior at crystal growth. A good agreement of the numerical estimates and the results of topographic investigations has been obtained.

UDC 669.017.11

Andreev Yu.M., Vaytulevich E.A., Svetlichny V.A.,
Zuev V.V., Morozov A.N., Kokh K.A., Lansky G.V.
APPLICATION OF THERMAL ANALYSIS
FOR CHARACTERIZING THE COMPOSITION
AND STRUCTURE OF NONLINEAR CRYSTALS GaSe

The differential scanning calorimetry method was applied for analyzing the composition and structure of pure semiconductor crystals of gallium selenide used in nonlinear optics. By the results of investigation of the efficiency in generating the second harmonics of CO_2-lasers and mixing spectral components of femtosecond Ti: Sapphire laser it was ascertained that linear optical and effective nonlinear properties of the crystals GaSe were considerably determined by relative content of the second phase, Ga_2Se_3.

UDC 661.832.321

Kuzminykh K.G., Poylov V.Z., Kosvintsev O.K.
THE INFLUENCE OF ULTRASONIC MACHINING PARAMETERS
ON CHEMICAL POTASSIUM CHLORIDE MILLING

The authors have studied the effect of ultrasonic machining parameters (affect intensity, duration, volume of suspension under machining) on grain composition of chemical potassium chloride. It was ascertained that at increase of ultrasonic affect intensity and machining duration the average crystal size decreases; at increase of the volume of suspension under machining the efficiency of ultrasonic affecting decreases.

UDC 537.528:537.529:622.233

Ivanov N.A., Pivovarov M.I., Voytenko N.V., Yudin A.S.
BLAST–HOLE DESTRUCTION OF ROCKS AND CONCRETE

The authors have studied the processes of blast-hole destruction of rocks and concrete using the polyethylene elecrtoexplosive cartridge. The article introduces the results of the laboratory current and voltage measurements. The resistances of the discharge channel and energy release dynamics in it at discharge initiation by exploding conductor both in water and polyethylene capillary have been calculated. It is ascertained that energy release in capillary discharge channel at the first current semioscillation is by ~15 % higher than in the discharge channel in water. It is shown that at stored energy in capacitive storage ~30 kJ the electric discharge destruction of samples with the size to 100×60×60 cm occurs.

UDC 620.179.14

Lapteva K.A., Tolmachev I.I.
DEGAUSSING FACTOR CALCULATION AT PARALLEL
MAGNETIZATION IN MAGNETIC PARTICLE INSPECTION

The authors have theoretically substantiated the degaussing factor calculation for infinitely long square bar and cylindrical samples magnetized along the axis at parallel magnetization in magnetic inspection including magnetic particle inspection. The article introduces the program which may be used for calculating the degaussing factor considering different ratios of length and diameter of the samples controlled.