CONTENTS AND ABSTRACTS

In this work a completely new explanation is given for newly-come snow formation. It is proved that it is the result of cavitations in the domain of the clouds. Nowadays the newly-come snow is considered to be a type of snow. But compared to snow the newly-come snow has the following principal contradictions: a) Certainly the newly-come snow is consisted of grains, but not of grains of microscopic measures. The grains have globelike form and a diameter about 1mm. b). The density of snow is 10-20 times smaller than that of newly-come snow.

A system consisting of two controlled objects which make special movements is considered. The task is set to construct control enabling the transition of the objects from the initial states to the given final states at different moments of time and guaranteeing that no collision takes place during the movement. An algorithm on the least period of time for simultaneous movement is proposed, by the help of which the task may be solved with any initial and final states...

In the present work the first boundary problem of compound body consists of three infinite wedges with arbitrary opening angles is investigated. Average wedge on the line of its bisectrix contains a crack of finite length the faces of which are loaded with equilibrated external loads

Due to the asymptotic method of solution of singular perturbed differential equations the solution of dynamic first boundary problem for the orthotropic strip of rectangle is found.
The solution is obtained from the internal problem solution as well as boundary layers. Iterative processes for the determination of tensor stress components and displacement vector are made.

On the base of the equations of a space dynamic problem of elasticity theory forced vibrations of anisotropic rectangular plates fastened by one of the facial surfaces with absolutely rigid foundation are considered. Anisotropy is general (21 constants of elasticity), on the opposite facial surface normal and tangential loads, which harmonically change in time, act. Using dimensionless coordinates and dimensionless components of displacement vector, the system of the space problem equations becomes singularly perturbed by small parameter, which is solved by the asymptotic method.
The asymptotic orders of all the sought values in the inner problem are established and the characteristic equations for determining these values are derived. It is shown that unlike the isotropic and orthotropic plates, the vibrations are not purely shear and longitudinal. The amplitudes of the forced vibrations are determined; the conditions of the resonance rise are established……………….....

The bending of a beam at the boundary of elastic half-plane

In the present work owing to new approach suggested in [1-3] the solution of beam bending contact problem of finite length on the edge of elastic half-plane is found. With the help of Fourier transformation and Wiener-Hopf method a problem solution is obtained in power series form with separated features. For the determination of unknown resolution ratios the infinite system of simple structure linear algebraic equations is received.

Development of algorithm of shaping of cotangential transition between elliptic and parabolic orbits

Given work is targeted at the method of construction development of cotangential trajectory of flights between given orbits during which it would be possible to use only the construction with the help of compass and ruler.

Definition mechanical properties of polymer-composites spar of the rotor blade of helicopter on the basis of static and dynamic tests

The structure of a fiberglass reinforced composite of a spar of rotor blade of the helicopter (mi-28) is in-process investigated. Static and dynamic methods of definition of mechanical properties of these composite materials are developed. It is developed cae - support of these tests on the basis of combination fem and genetic algorithms.

The stresses near the absolutely rigid coin-type inclusion in piecewise homogeneous space

The axis-symmetrical stress state of infinite elastic composite space from two different semi-spaces, when there is a absolutely rigid thin coin-type inclusion at the joint-plane, is considered. The closed solutions are built and the behavior of contact stresses near the boundary circle of inclusion is determined under the different models of contacting inclusion with semi-spaces.

Torsion of round stamp of elastic layer with free lower boundary.

An axisymmetric contact problem of round stamp torsion of elastic layer of finite but sufficiently large thickness with a free lower boundary is considered. The stamp is rigidly fixed on the upper boundary of layer and the torsional moment is applied to it. An integral equation concerning the unknown contact tangential force under the stamp is formulated.

About a uniform motion of power loads by the boundary of piece-homogeneous half-plane

A number of works are dedicated to the study of stress deformable condition of elastic homogeneous and compound bodies at boundary of which the power loads and absolutely rigid stamp are moving with constant velocity. In the present work the plane deformable condition of compound half-plane consists of infinite elastic strip and elastic half-plane with various elastic characteristics under the influence of uniformly moving concentrated normal and tangent loads when on the contact line of strip with half-plane the condition of full cohesion or smooth contact are taking place.

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A brittle strength of cutting plate in the parametric control of manufacturing process

During the nonferrous metal and alloy materials manufacturing the anisotropy of cutting plate from synthetic corundum determine different brittle strength of tool cutting part. The results of investigations of plate cutting part subject to the internal stresses and rate processes the brittle spalling and chipping of parts of material take place.

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Application of the method of optical-acoustic spectroscopy to the investigation of fatigue of contracture materials

The investigation of changes in mechanical properties of PMMA and tool steel during cyclic loading on bending is presented. Evolution of specimens properties was controlled at every 50000 cycles using the method of optical-acoustic spectroscopy. The method allows us to carry out the measurements of frequency dependence of sound velocity and attenuation and analyze their evolution in frequencies up to 100 MHz depending on the number of cycles. It is shown that the considered evolution of frequency dependence of transmission function may allow receiving some information on the evolution of scale levels of materials structure under the cyclic loadings. So the method of optical-acoustic spectroscopy of materials and structural elements allows developing the express-method to control the resource of constructions and increase the probability prediction of fatigue strength.

Robert Arutyunyan 70

The problem of deformation and radiation aging of plastic and elastic-viscous materials

N. Arutyunyan's elastic-viscous equations [1] capable to describe the aging processes of concrete gained general recognition and are widely employed in engineering practice. There are also publications, where N. Arutyunyan's equations are applied to creep and aging problem of polymers. At the same time these equations are expressed in the scale of the real time and the problem of deformation and radiation aging is not discussed. In our paper these problems will be considered in application to deformation and radiation aging of plastic and elastic-viscous materials.

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The method of building the biharmonic functions of strains

On the base of the properties of the δ – generative function it has been offered the method of solving of some classic problems of theory of elasticity which are concerned with biharmonic operator. Biharmonic functions of strains are offered in the obvious form through the elementary functions

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Reflection of two-dimensional magnetoelastic (spin-elastic) waves from the boundary of ferromagnetic elastic half-space

In magnetic-ordered crystals, particularly in ferromagnetic the elastic waves are accompanied with spin waves and vice versa, so in such mediums coupled spin-elastic or magnetoelastic waves are propagated [1-3]. In above mentioned works the results of volume magnetoelastic and spine waves as well as the results of surface waves which had been firstly investigated in the works [4-5] are brought. A quantity of interesting results of surface spine and magnetoelastic waves in layered medium have been received in the works [6] etc. In present paper the reflection of volume magnetoelastic waves from the boundary of ferromagnetic half-space are considered

About an interaction of stress concentrates various types

In many field of applied mechanics e.g. in mining mechanics, mechanics of composites etc. commonly encountered the problems of determination of stress-deformable condition of homogeneous and non-homogeneous elastic bodies containing various types of stress concentrates. In the role of various stress concentrates are mostly introduced the cracks and absolutely rigid thin inclusions

Optimization of Parameters of the Rectangular Plate under the Action of the Shearing Load

The optimal geometrical parameters of the rectangular plate, which secure the maximal load-carrying capacity of the construction under the action of the shear bending load, are determinate. The rectangular plate is simply supported by the longitudinal edges and is reinforced by transverse rigid ribs in the middle and at the free edges of the plate.

Piezoelectric surface elertroelastic wave of Love in a layered system of orthorombik substructures and isotropic conducting plat

In a paper "dispersiv solutions" of Love wave have been found.

Approaches to building up classic and non-classic type models of continua

Approaches to building up classic and non-classic type models of continua are considered.
Axiomatic approaches in classical continuum mechanics are discussed. The new theory is proposed to describe mechanical properties of resistance of materials: the system of concepts and axioms is introduced, the general reduced form of the system of constitutive relations is obtained including a constriction relation and constitutive expressions for stress field as well as for a field of mass-density of inner body-forces. The arbitrariness of these fields caused by the presence of inner constrictions is discussed. Special attention is paid to finite pre-history of bodies and to properties of (non-homogeneous) ageing studied in works by N.Kh.Arutyunyan. The general reduced forms of Ilyushin—Arutyunyan and Noll—Arutyunyan constitutive equations are proposed for media with an arbitrary (finite or ifinite) pre-history.

The influence of ageing on getinck's elastisity modulus taking into account the pressure of thermopressing

The results of investigation of elasticity module and getinacks' strength in depend on the ageing in laboratory conditions are considered. It is shown that the natural ageing brings to significant reduction of getinacks' elasticity module. Thus, the greater value of thermopressing pressure corresponds to the smaller value of elasticity module.

Analitical and Numerical Solution for Determination of Free Bending Vibrations Frequencies of Magnetoelastic and Piezoelectric Plates and Shells

By exact space treatment are derived dispersion relations of bending vibrations of magnetoelastic, ferromagnetic and piezoelectric plates. For the former ones are obtained simple formulae for frequencies by expansion on magnetic field parameter. Also are done numerical solutions of third order determinant equations for arbitrary magnetic fields. There are obtained sixth order determinant equations for shells made from mentioned materials and they are solved

About one problem of limiting state in case of abruption

The limiting state of plastic finite body in case of abruption is investigated. The correspondent stress and strain fields are defined.

About integral equations in the inverse problems of the theory of the elasticity

Method of the reduction of the inverse coefficient problem of the theory of the elasticity to iterative process is suggested. The iterative process solves the standard incorrect problem-equation of Fredholm first case with smooth kernel on the each step. The example of definition of a nongomogenius prestressed condition on the field displacement of the part boundary.

Spatial contact problem of the theory of elasticity for the finite cylinder and half-space under deterioration

In this work the space contact problem of theory of elasticity about contact of rigid cylinder and elastic half-space is considered. The cylinder rotates around its axe under acting forces and pressing in half-space. It is required to find contact stresses, displacement cylinder to half-space, and energy-power for cylinder rotating. The problem is solved with the help of the system of non-linear integral equations

The continuity condition in solution of plane problems of the theory of elasticity by the method of finite elements

The modified method of finite elements of quadrangular form under conditions of inter-element continuity of deformations and stress is considered.

A problem of orthotropic flexible strip of variable thickness by refined theory

A problem for orthotropic strip of linear-variable thickness with account of transversal shear by geometrically nonlinear theory is solved. Some modification of separate and joint actions of vertical and horizontal surface loads are investigated. A question of non-applicability of solutions superposition are considered.

Creep of carbon steels at high temperatures

The paper deals with creep of carbon steels at high temperatures when the creep is of short period character. Based on the results of carried out experimental research an analytic relationship describing rheological dependency of carbon steels at high temperatures has been suggested, and numerical values of approximation parameters have been obtained.

Effect of thin viscoelastic surface layers in contact interaction

The contact problems for elastic bodies coated with viscoelastic layers are considered under various loading conditions. The effect of imperfect elasticity of surface layer in dry and lubricated contacts is analyzed.

Several kinematic models of manipulator robots and problems of kinematic control are given in the report. The solutions of problems of kinematic control for examined kinematic models are given both with hard and elastic properties. The expressions of control functions providing the movement of manipulators in different criteria of quality are received.

The problem of existence of free vibrations of an elastic orthotropic thin-shell structure composed of identical non-closed infinite circular cylindrical shells with free and rigid clamping boundary generators and elastic orthotropic thin-shell structure composed of identical non-closed finite circular cylindrical shells with free and rigid clamping boundary generators with conditions of Nave's hinged support along boundary directional curve is studied.

The functions of the type of boundary layer are determined in work for different boundary conditions, is determined velocities of their decrease, when removing from lateral surface in inside shells. They are brought the first some numerical meanings of the velocity of the fading of function of the boundary layer. Execution analysis of the behavior of boundary layer for different boundary conditions

The problem of determining of stress-state visco-elastic space with finite-length slot under the conditions of anti-plane deformation by the theory of creep of inhomogeneously ageing mediums is considered. At the same time the analogical problem with the thin absolutely rigid inclusion instead of slot is discussed.

The present work is dedicated to the questions of stability of magnetostrictive plates in external magnetic field. An investigation is carried out on the base of linearized equations and boundary conditions describing the behavior of small perturbations in the magnetostrictive medium.

Nonlinear interaction of elastic waves in porous material (phase-group synchronism)

Nonlinear interaction of quasiharmonic longitudinal waves which propagate in solid porous material was investigated theoretically. It was shown that as a result of such interaction between low-frequency waves (vibration field) and high-frequency waves (ultrasound) an ultrasound wave of summarized frequency will be generated. This newly generated waves can be in a phase-group synchronism with the vibration field.

Inelastic deformation and failure of random-structured unidirectional fibre-reinforced composites under multiaxial proportional loading and shear

Algorithms for generating a random structure of composites were developed. The influence of morphology (size and shape) of reinforcement aggregates on the stochastic field properties were analyzed and the maximal volume fractions of fibres were determined. The results of computer-generation showed that a guaranteed matrix layer around every fibre is the necessary condition for appearing a periodicity in the random-structure fields. The generation of a composite structure with a high volume fraction of inclusions is accompanied by a quasi-determinate additional movement and rotation of fibres. These nonrandom modifications lead to a self-organization and regularization. By using the correlation analysis, the characteristic size of the representative volume domain was determined with account of the multi-particle interaction in the system of reinforcement elements. A special research into composite structures with randomly distributed fibre diameters allowed us to elucidate that the type of statistical distribution significantly influenced the character of multiparticle interaction on scale intervals from half to two average fibre diameters. These scales predetermine the strain and stress inhomogeneities in undamaged composites and produce the decisive influence on the initial stage of damage accumulation.

Diffusional mass transfer through a contact surface of rigid bodies under mechanical alloying

The developed multilevel model for process of mechanical alloying is presented in the report. A microlevel problem for welding and shattering of particles dust hitting between spheres at epicyclic mill is formulated. A periodic contact-problem for the diffusion through the external surface is solved for researching of mechanisms of cold (i.e. diffusion) welding conjugated surfaces of rigid bodies. Approximation of locally-equilibrium thermodynamics based on dependence of a chemical potential on the first invariant of stress tensor is used for description of diffusion. The bulk changes caused by admixture diffusion leads to changes of a stress-strain state and taken into account by the modified Hooke’s law. If the conditions of a small concentration of admixture is fulfilled, the problems for determination of stress and strain fields at the contact regions and for vacancy-type diffusion are solved separately for the known field of stress. A flux fields of admixture atoms are constructed under pressing of periodic-surface stamp into an elastic half-space. It is shown, that an intensity of admixture atoms under compression accompanied by shear is higher, than at pure compression and the micro-irregularities describing by tops of sinusoid leads to complicated stress field near contact zones and to more intensive diffusion.

Analytical and numerical methods in the contact problems for two-layer foundations

The contact problems for two-layer plane stripe,for two-layer cylindrical bearing in the plane andthree-dimensional statements and for two-layerspherical axisymmetric bearing are considered.For solving these problems the numerical - analyticalmethod and the finite element method with speciallydeveloped programs for finite element package ANSYSare applied. The analysis of numerical results iscarried out for different material parameters andgeometrical characteristics of the tribosystems.Finite element results are compared with the numerical -analytical results received from the solution of thecorresponding integral equations for the plane and axisymmetric contact problems.

On some relations in theory of stress state

Some relations of theory stress-state from which the main relations of the theory of limiting state [1] follow is considered.

Dynamic effects in a material at its structural - phase transformations

The problem of the description of structural and phase transitions in mechanics of a deformable solid is well-known. As a rule, the fact of such transitions is considered to be done, and the problem about presence of a biphase state is reduced to studying stability of interphase border. The question on dynamic character of transition from one stable branch of the static diagram $\sigma - \varepsilon$ on another stable and about influence of character of reorganization of the structure of a material till now remains open.

In the present work for the first time on an example of dynamically loaded road of finite length is considered the influence of parameters of the evolutionary equations describing reorganization of internal structure of a material, and also it is underlined an essential role of inertial forces of the road. In the mathematical interpretation it corresponds to studying of received equation of Lienar's type and, accordingly, of bifurcation points of a stable limiting cycle, and also strange attractor.

Axisymmetric contact problem about splice

In this paper we consider axisymmetric contact problem for viscoelastic foundation with a coating. We assume that this coating is ideally attached to a punch, i.e. a shape of the surface of the coating conform the shape of the punch base (the punch is glued to the foundation by thin coating). Such a problem often arises in engineering and technology.Two-dimensional mixed integral equation for this problem was obtained. It contains simultaneously integral operators with constant and variable limits as well as complimentary conditions. Using generalized projection method we construct its solution. A number of numerical calculations is realized. Qualitative conclusions are made.

Dynamics of prestressed structurally inhomogeneous electro-elastic bodies

The research results are presented for patterns of dynamic behavior for structurally inhomogeneous prestressed electro-elastic bodies, which are subjected to initial mechanical and electrostatical stresses. The analysis has been carried out in the framework of the linearized theory of superposition for a small deformation on a finite one and is based on a reduction of boundary value problems to the integral equations of first kind. The distinctive feature of kernels for these equations is oscillation, which is caused by structural heterogeneity of medium. The last circumstance implies the use of special methods for the solution of the integral equations, taking into account with a high accuracy the dynamic properties of medium.

The influence of old concrete's humidity extent on it elastisity properties

Results of changes of elastisity modulus and Poisson's ratio of old concretes investigated the dependance on the humidity extent both for the absorption and desorption of free moisture are brought.

A numerico-analytical splitting method for the solution of elastoviscoplastic equations with internal variables

The periodic wear – contact problem for a viscoelastic foundation

A wear model for the structurally inhomogeneous materials in contact with a viscoelastic body is proposed. Sliding with a constant velocity of the viscoelastic body over the rigid surface is considered. There is a complete contact between two bodies (without any gaps). The model is constructed for the steady state regime, when the stationary solution exists. The obtained results analyzed with respect to the geometrical and tribological characteristics of the inhomogeneous half space and the sliding velocity. The problem could be applied for the wear process of pavement by pneumatic.

Mechanics of accreted solids: state-of-the-art, problems, and perspectives

This paper is a brief overview of the scientific works in the new field of continuum mechanics — mechanics of accreted solids. The state-of-the-art of the theory and applications of accreted solid mechanics are under consideration. Main results of solving torsion, plane, and spatial problems are presented. The outstanding role of Academician N. Kh. Arutyunyan and his scientific school in the development of this new scientific field is underlined.

Some problems of accreted solids torsion

The theory of torsion of accreted solids mechanics is considered in this paper. Classical and non-classical initial boundary-value problems of solid mechanics are considered. Methods for solving problems of torsion of accreted solids are proposed. These methods are based on the reduction of non-classical problems of accretion of viscoelastic aging solids to the problems of elasticity with a time parameter. Some numerical results for accreted triangles are presented. In particular it is established that the maximum of share stress intensity can be not only on the surfaces of the accreted solids but inside them as well.

On a mixed problem for the elastic bar with a crack of finite length

The problems of cracks are closely connected with the problems of interaction of massive deformable bodies with absolutely rigid thin inclusions that are not resisting to the bending. Based on their theoretical and practical importance in the questions of mechanics of composites and strength of various engineering constructions they became the subject of investigation of different authors.

A plate under the action of tangential loads taking into account the transversal shears according to S.A. Ambartsumyan `s theory

A plate under the action of tangential loads taking into account transversal shears by the theory of S.A. Ambartsumyan is considered in the article. The problem is investigated under an arbitrary load and fixed edges. In particular case of constant tangential load is considered. It is shown that, in the presence of transversal shear the deflection reduces.

To plate flutter problem in supersonic flow in a case of concentrated mass at edges

The present paper is devoted to the analysis of the stability of a thin plate model in a supersonic airflow. The plate's mass is ignored, but it is considered than the concentrated mass is on the hinges supported and on the smooth contact edges. The critical velocity of the airflow are found, which reduce to the fluttered instability.

Optimization of elasic body geometry in the vicinity of singular points and its relartion to stress singularity

The problem of constructing singular solutions to the problems of elasticity theory has been the focus of attention of many investigators. In the context of two-dimensional problems the investigation of singular stresses is generally concerned with the analysis of stress state at the apex of a plane wedge. Within these problems consideration was given to almost all variants of wedge-shaped bodies. The solutions to two-dimensional problems provide data necessary for estimation of the stress singularity at the edge points of three-dimensional wedges. Examination of the works dealing with the investigation of stress singularity for other versions of three-dimensional problems (trihedral or polyhedral wedges, cones) has clearly demonstrated that the number of the obtained numerical solutions to this class of problems is rather small compared to the two-dimensional problems. In view of this fact we have proposed a method allowing us to analyze numerically the character of stress singularity in the vicinity of different singular points of elastic bodies. This method has proved to be rather effective for solving two-and three-dimensional problems in the cases, for which solutions by other methods are difficult if not impossible to realize. Among the problems solved by this method are a composite wedge made of linearly anisotropic materials, a trihedral wedge under different types of homogeneous boundary conditions at the lateral facets, circular and non-circular cones, hollow and built-up cones, cones with combined boundary conditions at the lateral surfaces. Estimation of the data obtained from the analysis of stress singularity has clearly demonstrated that these solutions have rather limited applications to strength analysis and numerical estimation of stresses in the bodies of arbitrary configuration.

Minimax aiming at several target sets for proper linear stochastic systems

The problem of rapprochement with m target sets when movement of system is described by system of the proper linear stochastic differential equations is considered. The stochastic hypothetical mismatch is constructed. The stochastic differential of a hypothetical mismatch which gives a condition for definition of extreme strategy is received.

Three dimensional problem of propagation of elastic surface waves in hexagonal piezoelectric half–space

The problem of propagation of elastic surface waves in hexagonal piezoelectric half-space, when on the surface of half-space all three components of stress and potential are equal to zero, is considered. It is supposed that the surface of half-space is plane of isotropy. It is shown, that in this case the parameter of speed of surface wave became greater, then in the case when $e_{ij} = 0$.

Method for estimation of retained vibro-strength of clay soils under the certain constant vibration acceleration values

The paper outlines a method for estimation of retained vibro-strength of clay soils, when its values, estimated under the different normal stresses, correspond to the same value of torsional vibration acceleration.

An anti-plane problem of contact interaction of layer with half-space taking into account the creep

In the theory of creep of non-homogeneous inherently-ageing bodies an anti-plane problem of contact interaction of infinite layer with half-space is considered. In various viscoelastic characteristics of layer and half-space as well as in the presence of definite external load a law of contact tangential stress distribution is determined. The solution of the problem with the help of Fourier transformation is brought to the solution of Volter second type integral equation. The numerical analysis is brought and defined conclusions are deduced.

The some problems for viscoelastic cylindrical shells and beams

The following solution of problems for viscoelastic (mainly typical materials) cylindrical shells and beams is brought.
1. Impact on end of semi-infinite cylinder,
2. Statical stability of cylindrical shell under moving load,
3. The stability of component parts of beam,
4. One dimensional contact problem for inhomogeneous viscoelascity,

Optimal control of motion of beam.

Micromechanical model of non-linear straining of shape memory alloys

Unique mechanical properties of shape memory alloys (SMA) are connected with thermoplastic phase transition taken place in these materials. In this investigation in framework of solid mechanics approach with taken into account the main micromechanical features of thermo elastic phase transition model of non-linear straining of SMA is created. This model qualitative and quantitative correct describes the total complex of properties and phenomena peculiar to SMA namely direct and oriented transformation straining, monotone, reverse and two way shape memory effects, martensite inelastisity, superelasticity, latent heat emanation and absorption during phase transition, dissipative phenomenon and so on. The micromechanical and thermodynamic system of constitutive equations for SMA is created. The different statements of boundary value problems and initial-boundary value problems of solid mechanics and thermo mechanics for SMA are investigated. Analytical and numerical methods for solution of these problems are proposed.

Influence of localized oscillations to diffusion-controlled growth of thin films

A thin film with growth islands is modelled as a two-component structure. The first material component of the film is the lattice submitted to elastic stresses. The second material component (the diffusion flux of atoms) is modeled by a fluid layer. Mathematically, the problem is reduced to analysis of a system of nonlinear equations describing the growth of island nuclei and wave propagation in the films. For the corresponding frequency-domain problem we present a trapped mode solution. It is shown that in the time-domain problem a perturbation force will excite a localized wave near the islands and in the absence of friction the wave will persist for all time. This creates additional stress in the film and leads to increase in the rate of island growth.

Limit analysis of difficultly reinforced ferro-concrete shells and plates

The problem of definition of the top cinematic border of carrying capacity difficultly reinforced ferro-concrete undergrad shells of rotation under action of mass loading is formulated and solved by a method of linear programming in view of active influence of a ground. It is shown, that to different ferro-concrete compositions there correspond the different rational structures of reinforcing providing the greatest maximum load. Various "mechanisms" of destruction of domes are investigated and the opportunity of existence.

The asymptotic form of free vibrations of multi-layer orthotropic plates

The asymptotic method is used to solve the three-dimensional dynamic problem of the elasticity theory on free vibration of multi-layer orthotropic plate at full contact conditions between layers. The lower side of the lower layer is rigidly fastened and the upper surface of the upper layer is free. The algorithm is formulated with program Mathematica to find the main magnitudes of frequencies of free vibrations at arbitrary quantity of layers.

Stressed state of three-layered hollow cylinder of finite length, rigidly fixed by one end and being under an action of gravity forces

An asymmetric deformation of three-layered in radial direction hollow cylinder of finite length L is considered in given work. One end of the cylinder is completely fixed, side surface and another end are free of stress, and the cylinder deforming only under the action of own weight that acting transversely to cylinder axis.

Strained deformed condition of instep and ways its parameters improving

It is considered the calculation of main factors of force and deformation in sections of shoes' instep depending on curve's form of instep's axis, the law of unevenly regulated load on it and the settling form of instep.

Some problems of elastic and viscoelastic solids accretion in mass force fields

The work researches laws of evolution of elastic and aging viscoelastic isotropic bodies stress-strain state in quasistatic processes of their sectionally continuous accretion in mass forces fields of various nature. The researches are based on fundamental approaches and methods of mathematical theory of accreted bodies. Processes of deformation of globe solids growing due to surface material onflow in an arbitrary central force field (e.g. the self-gravitation field) are studied. Processes of layerwise fabrication of cylindrical bodies and coatings via material application onto the external or internal surface of a rotating former or a billet are investigated taking into consideration the centrifugal forces. The problem of building-up a heavy round vault on a smooth foundation using such techniques as creation of initial stresses in the added constructs and local vault support during fabric is solved. As a result of analysis of all obtained solutions and numerous numerical computations performed some noval mechanical effects are discovered and thoroughly studied. A number of practically important conclusions is made. Some general aspects of mechanical behaviour and state of elastic and aging viscoelastic bodies growing and having been formed during an accretion process are studied.

The crack-resistance of composites reinforced by nanofibers

The substantial increasing of nanocomposites fracture toughness is based on the strengthening effects of reinforcements by nanofibers. The model of a crack with a large scale bridged zone is used to analyze the fracture toughness of these materials. The evaluation of mechanical parameters is performed on the basis of the fracture criterion for cracks with bridged zones. The estimations of the fracture toughness, the adhesion fracture energy and the external fracture stresses depending on the crack size are also presented.

As it is known at decreasing of stresses in time the theories of creep describe the creep strain of materials very badly. For example, the theory of hardening often does not describe the reversal creep and the theory of heredity on contrary describes reversal creep considerably more than it is in reality.

In the present work the version of heredity with delayed plasticity is considered and the experimental results obtained from creep of chromium-nickel steel and of clay soils, confirmed this version are presented.

A model is proposed for calculating of parameters (such as wear and friction coefficient) of metal-polymer tribocontact. It is based on the molecular-mechanical friction theory and adhesion-energetic mechanism of friction transfer. The modeling is proposed for evaluation of tribological parameters by means of conducting virtual experiments.

The work considers an aggregate of elementary types of defects, i.e. plane cracks and rigid inclusions, located in the elastic layered medium in parallel planes. A new method has been offered for developing matrix-functional relationships for the problem under study, which makes it possible to study effectively stress and strain state of elastic media containing numerous defects.

The anti-plane stress state of homogeneous elastic space, weakened by T-form crack with mixed conditions on banks is considered. The determining equations of formulated problem are obtained as a system of singular integral equations. The solution of system is built by the numerical-analytical method of discrete singularities.

In this paper is analyzed the interaction of magnetic (spin) and antiplane-elastic surface waves in homogeneous ferromagnetic elastic layer. The existence of magnetoelastic surface waves is shown. Also, the existence of a frequency range of waves, which are not passed by media, is shown.

The unified approach to solve problems of stress distribution around sharp and rounded V-shaped notches based on singular integral equation method was proposed. At first, the problem was solved for an elastic domain with V-shaped notch with rounded vertex of large curvature. Then the passage to the limit was used to obtain stress intensity factor at the vertex of sharp V-notch. Numerical results for a rhombic hole in an elastic plane and for an edge V-shaped notch in a half-plane were discussed.

Calculation and analyze of plate, which two opposite edges of the plate jointly supported,other two edges are free

A problem of plates bending with uniformly distributed load has been solved by Kirchhoff theory, improved theory and by numerical methods (method of finite elements). Two opposite edges of the plate are jointly supported, other two edges are free. The behavior of cutting forces and bending moments in corners and in edges of plate is investigated. It is shown, that in the corners of the plate, when thickness is lessening the point forces arise, which are equal to point forces by Kirchhoff theory in magnitude. With the help of creating program on influence of plate sizes and coefficient of Poisson on kinematical and statistical characteristic of plates have been investigated.

An elastic equilibrium of circular sector at the boundary conditions of smooth contact on the radial sides

The plane problem of the theory of elasticity of circular sector with single radius and opening angle $\alpha\left(0<\alpha<2\pi\right)$, when on the boundary $r=1$ external loads are given and on radial sides $\varphi=0$ and $\varphi=\alpha$ are putting into effect the conditions of smooth contact (the conditions of contact with rigid stamp without friction) is investigated.

The plane problem of the theory of elasticity with non-classical boundary conditions

The plane problem of the theory of elasticity for the rectangular and circular regions area is considered when on one edge the boundary conditions are underdetermined and on the other edge they are over determined. In case of rectangle area the general solution of biharmonic equation having the form of Fourier's series with unknown coefficient problems is reduced to the solution of infinite systems of the linear algebraic equations.The regularity of the system is studied which is comparable with the case that corresponds with the problem of classical boundary conditions. The solution is illustrated by an example with finite amount polynomials. For circular ring region in case of axis-symmetric pressure, the solution obtained as the problem of thermoelasticity.

To the theory of non-linear viscoelastic shells and plates with consideration of transversal shear

During the last years the significant attention is given to the deformation calculations, which based on the linear theory of viscoelasticity. At the same time the gap was formed between problems readiness in these frameworks and almost absence of the proved calculatation tool, which considering nonlinear viscoelasticity, based on sufficient number of experimental data.In the present work the calculation tool is constructed for definition of stress-strain condition of nonlinear-viscoelastic shells and plates with taking into account the transversal shear.

Continual Theory of Micropolar Elastic Multi-layered Thin Plates

In present work the asymptotic method is developed for constructing continual models of layered thin plates on the basis of micropolar (asymmetrical, momental) theory of elasticity. Depending on the values of physical constants of micropolar materials, there are constructed three different continuall theories of micropolar layered thin plates. The first theory is - the continual theory of micropolar layered plates with free rotation, the second theory is - the continual theory of layered plates with

Stabilization of statically unstable systems by vibration

A problem of stabilization of a vertical (inverted) position of a pendulum by high frequency vibration of the suspension point is considered. Small viscous damping is taken into account, and periodic excitation function describing vibration of the suspension point is assumed to be arbitrary. A formula for stability region of Hill's equation with damping near zero frequency is obtained. For several examples it is shown that analytical and numerical results are in good agreement with each other. An asymptotic formula for stabilization region of the inverted pendulum is derived. It is shown that the effect of small viscous damping is of the third order, and taking it into account leads to increasing critical stabilization frequency. The method of stability analysis is based on calculation of derivatives of the monodromy (Floquet) matrix with respect to parameters [1]. In 1956 V.N. Chelomei showed that elastic systems can be made more stable by imposing vibration. In particular he came to the conclusion that the elastic column compressed by an axial force exceeding critical (Euler) value can be stabilized by high frequency excitation force applied to the end of the column. In this paper formulas for higher and lower critical frequencies of the column stabilization are obtained. It is shown that unlike high frequency stabilization of an inverted pendulum with vibrating suspension point the column is stabilized by excitation frequency of the order of the main eigenfrequency of transverse vibrations belonging to some interval.

On substantiation of the Navier solution

The Navier solution $w(x, y)$ for deflection function in the problem of bending of a rectangular simply supported plate is studied. The plate is supposed to be loaded by a uniform pressure distributed on the rectangle with the sides, parallel to the sides of the plate. The author uses his original approach, which is based on some results of the classical theory of functions, to prove that

a) $w(x, y) \in C^3$ in a closed rectangle G of the plate. The partial derivatives up to the third order in G can be calculated by differentiating the Navier series term by term under both symbols of summing.

b) All the derivatives $\partial^4 w(x, y) / \partial x^k \partial y^{4-k}$, k = 0, 2, 4 are continuous functions in set E which is coinciding with subtraction from G the lines passing through the sides of the rectangle of load application. In E these derivatives can be calculated by differentiating the Navier series term by term under both symbols of summing.The obtained results substantiate the Navier solution.

New possibilities of electromagnetic radiation method for study of high-velocity processes in microfibers

The main objective of the present work is to develop this promising method and to show its possibilities for registration of fracture and wave propagation phenomena within the non-conductive micro fibers. With this aim, special experimental systems have been devised. The electric signals were recorded by an antenna over radio range of frequency spectrum. Many tests have been carried out with the artificially charged fibers in order to study their transversal oscillations as a string (polymer fibers) or as an elastic cantilever (glass fibers). As a result, a new method for obtaining dynamic elastic parameters of thin fibers by means of measurements of frequencies of these oscillations with help of the electric signal registration has been developed. This method also can be used for nondestructive damage control of a fiber face. The basis for such possibility is the effect of sharp increasing decrement of the charge resolution from the fiber surface which has been revealed in the experiments with repeated oscillations of the glass fibers. The glass fibers 6.5, 10, 18, and 150 μm in diameter and polyethylene threads from fibers (~10^2) 7-12 μm in diameter and fibers (60-300 μm) also were tested in the experiments on fracture at tension as well.

dispersion of elastic surface Rayleigh waves. Components of displacements and rotations have been analyzed in detail. A new solution has been obtained which has no analogous in the classical elasticity theory. This solution can describe the wave with one transverse component of the displacement vector and two components of the rotation vector propagating in the plate.

On the Problem of Electroelastic Shear Waves Propagation in the Piezoelectric Layer with the Fastened Surface

The possible control of process of electroelastic shear waves propagation in the piezoelectric layer with one fastened surface at different piezoelectric crystals is considered, when the material of the layer is a piezocrystal of the class 6mm in case of which localization of wave energy is possible at free boundary of half-space.The influence of the fastened surface on existence of an electroelastic wave and on distribution of electroelastic wave energy along the thickness of a layer as well as the influence of temporary electroelastic load on the behavior of advancing wave is considered.

On the Inverse Problem of Impact

The inverse problem of impact in the frames of rigid body mechanics is considered.It is assumed, that parameters (the mass, the velocity before and after impact) for one of collided bodies, which possess relatively small mass, cannot be observed or measured.This definition of problem simulate the outer impact of small-mass unknown bodies with the satellites, aircrafts or the inner impact of unknown small-mass fragments, which are break away from equipment in the closed volumes as stream-generators, nuclear reactors, pipelines.In order to construct the closed system of equations the Newton's suggestion on the constancy of ratio of relative velocities of bodies before and after impact is applied and a new coefficient is introduced. This coefficient specifies the distribution of the restitution potential energy among colliding bodies.The solution of received equations system is illustrated by the examples.

Thermoelastic equilibrium boundary value problems for weakly transtropic cylindrical bodies

A precise solution of some boundary value and boundary- contact problems of the thermoelastic equilibrium of one- and multilayer bodies, bounded by coordinate surfaces of the cylindrical coordinate system is constructed using the method of separation of variables. The cylindrical surfaces of the body are affected by a stationary thermal field and surfacedisturbances (the stresses, displacements or their combinations are defined). On the remaining part of the surface homogeneous conditions of symmetry or anti-symmetry are defined. The elastic body is assumed to be weaklytranstropic (transversally isotropic) with the plane of isotropy orthogonal to the cylindrical surface. Weakly transtropic layers of the multilayer body contact along the cylindrical surfaces.

Optimization of parameters of high-speed rotor on combined supports

It is considered the task of a choice of optimum elastic - geometrical parameters of high-speed rotor settled on combined supports. Proposed algorithm and program of calculation are used for solution of optimization problems to minimize dynamic loads in supports and the amplitude of rotor's vibration.

Finite element analysis of the localized instability of plates with free edge

There are many problems in Mechanical Engineering, which engineers couldn't solve analytically or it demands huge expenses for the experimental realization. Particularly the unique opportunity of the express analysis is computer aided mathematical modeling. The most widespread and universal method of engineering analysis is the Finite Element Method - (FEM). In this work the Finite Element analysis of the problems of the localized instability of a plate with free edge is considered and discussed. Comparative analysis of the values of the critical loading obtained analytically and by FEA analysis is curried out.

The non-linear (physically, geometrically) viscous (generalized model) dispersive elastic medium is considered. In such media are possible slowly variating (equilibrium) and rapidly variating (frozen) waves. In the last case in expressions, connecting stresses and deformations as basic functions are taken $\dot{\sigma}_{ik}$, $\dot{\varepsilon}_{ik}$. From general system are derived equations describing rapidly variating waves. Are derived for layer evolutionary equations for two waves, on one edge of layer are given longitudinal displacements, and other edge is free from stresses. Are obtained nonlinear modulation equations for mentioned waves and are derived solutions for narrow beams, when coefficients of modulation equation are the complex numbers.

The vibrations of electrical machine spinning rotor in the magnetic field taking into account the irregularity of air clearance between rotor and stator, field pulsation and higher toothed harmonics are considered. The investigations of the system of obtained nonlinear equations of Mathe-Hills' type allowed to substitute the zones of indefinitely-increasing solutions on the flatness of parameters and received the conditions for the determination of dynamic instability region boundaries.

In this article the existence and the propagation behavior of magneto-elastic Love waves in a layered structure consisting of an isotropic dielectric substrate, an isotropic magnetostrictive layer and a dielectric medium is considered. The mathematical model of the problem is formulated. The dispersion equation for the existence of Love surface waves is obtained with respect to phase velocity. Numerical investigation of the solutions of the dispersion equation is carried out.

Using integral transformations method unsteady plane and three-dimensional problems of elasticity for semi infinite stumps and cracks are derived correspondingly two, three, four and six Wienner-Hopf equations, which are regularized and brought to Hilbert problems with continuous matrix. The solution is brought to corresponding order system of Fredholms integral equations, which are solved numerically by program Mathematica 5.1. Thus it is solved mathematical problem of factorization of complex matrices. Besides in all cases are inverted integral transformations on time and coordinates and are obtained effective solution in Smirnov-Sobolev form for stresses on surfaces of half-planes and half-spaces under punches as well as on banks of cracks. Also there are obtained and calculated stress intensities coefficients near edges of punches and cracks.

Numerous papers consider stability of a rod under follower force. However, only few contributions are available on stability of rectangular plates under follower forces [1][2]. In the present paper a rectangular plate is considered, such that two opposite edges are hinged, and two others are free, loaded with follower forces. The problem is split into determination of symmetric and anti-symmetric shape of loss of stability. For symmetric shape, critical loads are determined using both static problem statement and dynamic problem statement, based on model suggested by Bolotin V.V. [3]. It is shown, that if the plate is narrow enough in the direction of loading forces, the critical loads of dynamic problems (flatter critical loads) are significantly smaller than critical loads of static problems (buckling critical load).

Using laws of thermodynamics for derivingdynamic boundary value problem and heat conduction equation of ageing piezothermoelastic materials

The set of basic laws of thermomechanics includes the equations of motion formulated in terms of balances of momentum and moment of momentum, state equations and two laws of thermodynamics. The intent of the presentation is to show that the dynamic boundary value problem, state equations and the heat conduction equation for certain simple materials are derivable from the first and second laws of thermodynamics in the framework of the geometrically nonlinear continuum mechanics. This idea is applied to "ageing" (time-dependent) simple polarized thermoelastic materials. In the present analysis only mechanical, thermal and electromagnetic phenomena are considered, i.e. the energies associated with e.g. chemical conversions and others excluded from the present analysis. It is also shown that the conventional form of the heat conduction equation for geometrically nonlinear anisotropic polarized thermoelastic media does not satisfy the principle of material frame indifference. A necessary correction is made.

On explicit solution to the equation system of thermoelasticity

In the paper the fundamental and some other matrices of singular solutions are constructed for two-dimensional equations to thermoelastic transversally isotropic body. Using these matrices, the simple and dual layer type potentials are composed and their fundamental properties near the boundary are studied.The explicit solutions to first and second boundary value problems of thermoelasticity are constructed for the two-dimensional equations of thermoelastic transversally isotropic half-plane. For their solutions we use the potential method and we constructed the special fundamental matrices, which reduce the first and second BVPs to a Fredholm integral equations of the second kind. By the aid of these equations, in this paper we have obtained the Poisson type formula for the solution to the first and second BVPs for the half-plane.

The intense and deformed condition with the structure of the water head spillway hollow dam

The stress-strain state of a cylindrical upstream face of the type dam is studied by using the semi-moment shell theory, and the calculation of the foundation tile is conducted for one and multi-layer areas on an elastic foundation with two characteristics. Computer software for numerical implementation of theoretical solutions has been developed.

Localized bending vibration of a rectangular plate with one free and three clamped edges

The dynamic problem of localized bending waves in thin rectangular plates is studied. The plate has one edge free from mechanical stresses, while the other three are assumed to be rigidly clamped. This type of structural configuration corresponds to several engineering systems, and the specific set of boundary conditions has been selected also to simulate damaged structural components with cracks. A time-harmonic plane wave solution is assumed; using variational methods the necessary and sufficient conditions for the existence of a localized bending wave are obtained. The frequency of the localized wave is the lowest among the spectrum of natural frequencies of the plate. For finite and semi-finite plates, the minimal frequencies of localized mode are derived analytically, as a function of mechanical properties and geometrical parameters of the elastic plate.

A numerico-analytical splitting method for the solution of elastoviscoplastic equations with internal variables

Consinstent eulerian elastoplaasticity

An Eulerian theory of elastoplasticity may be based on the additive decomposition of the stretching D in a recoverable and a dissipated part, i.e. $D = D^{e} + D^{p}$. Herein, the recoverable stretching D^{e} is intended for the elastic resp. elastic-like behaviour while the dissipated stretching D^{p} is related to the plastic flow in conjunction with a yield function f and hardening variables κ for the isotropic hardening and α for the kinematic hardening. Since the spatial description relates to the actual, deformed, configuration, special care has to be taken for formulating the material law in an objective, frame indifferent way. This is of primary importance not only for the tensorial quantities in use but also for their time derivatives.Based on Prager's yielding stationarity criterion [1], the exact integrability condition [2, 3, 4] and a weakened form of Ilyushin's postulate [5, 6] a consistent Eulerian description is presented that excels by the restricted number of material parameters and the simplicity of its formulation, and, moreover, is exempted from notions of elastic and plastic deformation.

Elasto-plastic analysis in soil and rock mechanics by using hybrid-type penalty method

This paper presents new approach for the numerical analysis in the soil and rock mechanics by using Hybrid-type penalty method (HPM). HPM with the linear displacement field assume rigid displacement, rigid rotation and constant strain as the parameter in each sub-domain and introduce subsidiary condition about the continuity of displacement into the framework of the variational expression with Lagrange multipliers. This compatibility of the displacement on the intersection boundary is approximately introduced using the penalty as a spring constant which is applied to the Lagrange multiplier. Present method can be deal with the fracture on the intersection boundary and yielding in the each element at the same time. First, We explain the formulation of HPM. In addition, we develop the nonlinear analysis for the progressiveness destruction, and examine accuracy of the collapse load and crack patterns. Finally, we apply to some geotechnical engineering problems, and verify the validity of HPM.

The Penetration of Deformable Indentor into Half-Space in the Presence of Discharge Current and Magnetic Field

The penetration of deformable indentor into target in the presence of magnetic field are investigated numerically. The fields of stress in target and indentor are determined. The forms of indentor, crater and free surface in arbitrary moment of penetration are founded. Shown the form of fly away of fragments. The problem for different time of action of magnetic field are considered. The graphs of velocity of indentor in the process of penetration, the equipotential surface of energy in target and the bounders of elastic-plastic regions in target and indentor also are obtained. By numerical calculations as a result it's obtained the occurrence of the surface and axial-closely currents during the penetration process of the deformable indentor into the media, which are known as Pinch-effect and the Inverse-pinch-effect phenomena.

Basic Systems of Equations of Continuum Mechanics and Refined Theories for Thin-walled Viscoelastic structures

There is constructing three-dimensional(3D respect to spatial coordinates) nonlinear dynamical systems of partial differential equations(PDE) which contains as particular cases Navier-Stokes' equations and nonlinear systems of PDE theory of visco-elasticity. By this presentation we prove that nonlinear appearances, observed in problems of solid mechanics may be detected in the Navier-Stokes' type equations and vice versa. In the second part we are creating and justifying 2D mathematical models (refined theories) of von Karman-Mindlin-Reissner type system of PDEs for anisotropic elasto-creeping media for thin-walled structures with variable thickness by direct method without emploiment simplifying assumptions of geometric or mechanical characters. Our methodology is different with considerations of [1]. In this aim we also investigate the problem of explaining "Physical Soundness" in the Truesdell-Ciarlet sense for some dynamic nonlinear models of visco-elasticity.