CONTENTS AND ABSTRACTS

Keynote Lectures

The essence of asymptotic method solution of singularly-perturbed differential equations is explained. The mentioned method is applying for the boundary-value problems of statics and dynamics of thin bodies (beams, plates, shells) solving. The general results is illustrated by the solutions of determined classes problems.

In this work the new approach to determination of asymptotic formulas is demonstrated by solving example of problem on shear plane wave diffraction in elastic plane at semi-infinite crack edge. As opposed to well-known traditional methods, the solving of problems like these [1-3] is deducted to Riemann-type boundary problem for real axis [5-10]. In order to investigate the solution obtained in the form of Fourier integrals, the sections are drawn across the coordinate axis in complex plane, and as a result, the problem solution is represented in form of regular integrals in sections.

Problems connected with developing of transformable space structures that shape during transportation into orbit is different from the one deployed in space, are under consideration. Execution of ground tests for such structures is a very difficult problem and, in addition, frequently a proper flight simulation is impossible. So, mathematical simulations and computing experiments become the main tools for deployable space structure developments.

An asymptotic approach to the solution of the non stationary boundary-value problems for thin shells is obtained. The problem that determinate the stress and strain state of the semi infinite elastic shell, loaded by percussion action on the end, is considered. In the case of cylindrical shell and the percussion loading of normal type the solution may be separate on the components with different indexes of convertibility. For each component one can obtain rough asymptotic models that are easier than exact model. Due to existence of the domains of congruence it is possible to join the solutions of rough equations and to find with small inaccuracy the unified approximate descriptions of stress and strain state of the shell in whole domain of space and time variables.

On the basis of rational thermodynamics of irreversible processes the system of the defining equations, which take into account the processes occurring in materials at the micro level, is offered. For this purpose the internal state parameters, which allow considering phase transformation of type "austenit-martensit", final speed of heat distribution and effects of viscous high-speed deformation are entered into consideration.In addition, the mathematical models, taking into account the effects of a nanostructured material (a lower thermal conductivity and higher heat capacity, as well as lower temperature deformation, as compared with solid material) are considered.

In the present article three aspects of the method of orthogonal functions is discussed. The first aspect is connected with the method of M.G. Kreigh solution of integral equations of Fredholm first and second type, originally based on inverse problem of spectral theory of differential operators.

Second one is connected with spectral relation for the main integral operators of the theory of mixed and contact problems obtained by the methods of theory of accepted and generalized potential in the different orthogonal curved coordinate systems. Finally, third aspect is connected with method of calculation of singular integrals with Cauchy and Hilbert kernels as well as with other related kernels with the help of quadrature Gauss` formula with application of classical orthogonal polynomials and by usage of these methods in the solution of singular integral equations.

For high Reynolds numbers any flow of viscous fluid is turbulent, and exact calculation providing correct treatment of oscillating turbulent velocity components becomes very complicated. In the meantime, the information about oscillating velocity components plays key role, for example in such fields like aeroacousts. In this connection various numerical methods, efficient both for laminar and turbulent flow, were applied to solve the nonlinear Navier-Stokes differential equations. The aim of the present work is to construct a semi-analytical method founded on classical iterations over time. At each iteration step the problem is reduced to a certain linear elliptic problem whose solution is constructed in an explicit form on the basis of respective Green’s function. The Green’s function itself is constructed explicitly.

To describe the mechanical behavior of heterogeneous (composite, ceramic) materials, formed of linear elastic and nonlinear viscous components, the modified Maxwell equation is introduced. The energy conservation law is applied to formulate the fracture criterions for heterogeneous materials and common metallic alloys. As an example, the fracture criterion for the ceramic composite is formulated. The energy approach to the fatigue fracture problem is also discussed.

Section reports

Using asymptotic method, for the laminated thin bodies the formulas for determination of integral characteristics of elasticity of laminated packet, composed of orthotropic or isotropic layers, are obtained.

A class of problem on forced vibrations of strip, the material of which in plane of strip has general anisotropy, has been solved. It′s considered that on one of the longitudinal edge is given vector of displacement, which is changing in time harmonically, and on the opposite edge homogeneous, mixed conditions are given. General asymptotic solution of interior problem has been found. It′s shown that it is completely defined after the satisfaction of the conditions on longitudinal edges. It has been established that vibrations are not purely shear or purely longitudinal. Amplitude of vibrations are determined, the conditions of arising resonance are derived.

The plane stress state of homogeneous elastic plane, weakened by semi-infinite slit, perpendicularly located against the middle of finite-length crack is considered. The determining system of singular integral equations with respect to derivatives of difference-functions of displacements is deducted. The solution of problem is built by the numerical-analytical method of discrete singularities.

The strain stress state of homogeneous elastic plane, strengthened by finite absolutely rigid inclusion and weakened by two slits, perpendicular against the inclusion and symmetrically located against middle point of inclusion is considered. The determining system of singular integral equations with respect to derivatives of difference-functions of displacements and tangential stresses, acting under the the inclusion, is deducted. The solution of problem is built by the numerical-analytical method of discrete singularities.

The micropolar, asymmetrical, momental theory of elasticity, or called otherwise, the Cosserate continuum, constitutes a model for elastic deformable solids with internal structure. The present paper focuses on the study of the plane boundary problem of micropolar theory of elasticity for orthotropic material in a thin rectangular area. Thus, based on the asymptotical approach, demonstrated in works by S. H. Sargsyan, the one-dimensional mathematical model of static problem of micropolar orthotropic thin elastic bars is constructed. In the present paper depending on values of dimensionless physical parameters of orthotropic bodies we investigate the two variants of their values and construct the one-dimensional models of static problem of micropolar orthotropic thin elastic bars with free and constraint rotations. ....

In this work the problem of contact interaction of bend of a joist (beam) with limited length is considered. The solution of the problem is brought to the solution of singular integral equations, nucleus of which is represented by means of the sum of the nucleus of Coshie and regular functions. The solutions of singular integral equations is constructed by means of polynominals of Chebishev with the well-known numerical-analytic method, and the numerical values are got for the charachteristics of the problem.

In the present work considered axisymmetric stress state of the infinite hollow cylinder when on the inner surface of the cylinder uniformly moving, concentrated normal and tangential loads are acting, and the outer surface of the cylinder is free or clamped. The dispersion equation for waves in a hollow cylinder is studied.

We consider two material periodic structures in three dimensions made from linearly elastic materials with the fixed volume fraction. The internal structure of the composite is not given. It adapts to the external strains so that the strain energy of the composite material is minimal. Thus, the internal structure is unique and the stiffness of the composite is minimal for every strain fields. We explicitly calculate a lower geometrically independent bound for the elastic energy that is valid for all structures. This bound is a polyconvex envelope of the corresponding two-well Lagrangian that describes the optimization problem. Analytic expression for the bound depends on external strains and it has several different analytic components for different ranges of the strains. Then we show that the obtained lower bound is exact. Optimal structures store the energy predicted by the lower bound and thereby they match it. In our work, we utilize a technique developed earlier, where asymptotic case of the rigid second material was described.

In this article is investigated the stress-deformation estate of bending plate in around of fixed edge by approach of Nadai A. The deflection, bending and twisting moments and cutting forces are defined by the theory Ambartsumyan S.A. in around of fixed edge of plate. The comparison in this article is show, that the results by classical theory is coincide with the results by refined theory with accuracy by neglection of a square of relative thickness.

In research work there is observed friction process between materials of copper and aluminium alloys (according to brass LC59-1 and duralumin D16) and a cutting plate from synthetic corundum. And as well the questions of working out of the mathematical model intended for research of a contact surface length of the preparation processed part with a back surface cutter at milling by cutting plates from synthetic corundum is considered.

The problem of contact interaction between an elastic layer and elastic half-space possessing various elastic properties under torsion is considered. At first the determinative differential equations of a thin elastic layer are deduced by means of Hankel integral transform from the exact differential equation of the theory of torsion elasticity of a layer in various accuracies, i.e. various mathematical models of torsion of a thin elastic layer are plotted. In particular, the known models of Melan and Winkler are obtained on this way. Then, the contact problem specified above or a problem about the stress condition of a composite in the form of an elastic layer and elastic half-space is examined in exact problem statement and in statements of various models of an elastic thin layer. All these problems are reduced to Fredholm integral equations of the first sort. Their closed solutions are plotted and their comparative analysis is carried out.

In this work the existence and behavior of Love electro-elastic waves [1,2] in three-layer system of piezoelectric substrate of class 6, 4, 6mm, 4mm and two attached isotropic conducting layers [3-5] Pt and Al of arbitrary thickness h_1 and h_2 is investigated. Particularly, the existence of slit type Love wave, conditioned exclusively by piezoelectric effect, is shown. The dispersion equation, structure and behavior of Love wave mode is investigated. Qualitative diagrams of dispersion curve are made.

The problem of variable thickness plate streamline with non-stationary supersonic ideal gas flow (at low Mach number) is considered. The problem is investigated on the basis of approximate model which in its exactness is considered to be “intermediate” between “exact” and “piston” theories. Approximate approach of determination of principal form of vibration has been used which is matched with some well-known exact forms. Bubnov-Galerkin method is used for the solution of the problem. The stability regions are determined in parameters` surface with the help of Routh–Hurwitz stability criterion. The numerical example is brought as well as stability zones and flutter is constructed.

Due to the lack of dam crest elevation the article presents the most reliable and safety solution for flood outflow by using fusegates system of 'HYDROPLUS' company. It is shown that its application allows for increasing the storage capacity of the reservoir by 15.0 million of cubic meter.

The new class of control problems with probabilistic control parameters in case of normal distribution is discussed. The problem of dispersion variation that considers the technical and economic indicators of the probabilistic systems under investigation has been considered for the first time. It is shown that there is special class of problems, in which the achievement of maximal efficiency is possible by the way of not minimization of dispersion, but by the choice of optimal value that in particular case is equivalent to the choice of optimal accuracy of control. The conditions at which the optimization problem of dispersion makes sense are obtained. A private example is solved.

A problem on torsion of a round cylinder of finite length is discussed. On the edges of the cylinder turning loads of arbitrary intensities are applied. It is assumed that the finite cylinder is composed of an arbitrary number of cylinders of different lengths with various elastic characteristics welded with each other on the edges. It is also assumed that the lateral surface is rigidly fastened. It is required to determine contact stresses on the joint edges of the cylinders.

Free vibrations of two-layered orthotropic shells in full contact between layers at the boundary layer are considered. Characteristic equations for determining speeds of plane and anti-plane boundary layer function damping when moving from edge surface into the shell are obtained. It is shown that a boundary layer corresponds to each eigenfrequency of free vibrations of shell. Some first numerical values of speed of boundary layer function damping are given.

In article brief characteristic dam of Akhuryan and area of construction is given. The information about site water basin of Akhuryan. Results before the carried out geodetic supervision. Advantage of a method of hydrolevelling. Necessity of new geodetic supervision is in detail proved.

The problem of the optimum design of the rectangular infinitely long laminar plate, prepared from the composite material, reinforced by the periodically located stiffening ribs, under the action of transverse load is solved. With the condition the conservation of the structural weight and the limitations, assigned on its strength, are determined the optimum geometric and physical parameters of the construction, which ensure its maximum bearing capacity.

In exact statement of linear elasticity theory it has been considered the stress deformated statement of elastic band weakened by the limited crack. The crack is located on a line parallel to borders of band on which compressing forces operate. It is supposed, that as a result of flat deformation under action of compressing forces the coast of a crack contact among themselves and points of various coast of a crack slip one above the other.

Yemelianov A.G...208
The Investigation of Elastic Circle-Cylindrical Finite-Length Shell With Ideal Incompressible Fluid

The axis-symmetrical problem on interaction elastic circle-cylindrical finite-length shell with ideal incompressible fluid is considered. The results of numerical investigation are shown in article.

Zakaryan T.V. 214
On the Boundary Layer in Three-Dimensional Problem of Forced Vibration of Orthotropic Plate

The first dynamical boundary problem for isotropic bar – beam is solved by asymptotic method in [1], and for orthotropic bars in [2,3]. In this work on basis of dynamical equations of three-dimensional problem of elasticity theory for orthotropic plates, the boundary layer is studied by asymptotic method. The characteristic equations for determination of decreasing velocities of values of boundary layer when moving off the lateral surface have been obtained. It is proved that the boundary layer decomposes to the plane and out-of-plane boundary layers. The problem of conjugation of solutions of boundary layer and internal problem is considered.

Kazakov K. 219
***Contact Interaction Problems For Visco-Elastic Bodies With Coating*.**

In present work the contact problems for bodies with thin coating are investigated. Two classes of such problems are considered. For both classes the mixed integral equations are obtained. The analytic solutions of equations are built by A. Manzhirov generalized projection method.

Kovalev V.A., Radayev Y.N., Semenov D.A...225
Null Lagrangians of the coupled dynamic GNII-thermoelastic field

The canonical and natural definitions of tensorial characteristics of the coupled dynamic GNII-thermoelastic field are given due to minimum of the thermoelastic action integral and variational symmetries of the corresponding variational functional. The non-uniqueness of the canonical tensor fields, defined by the aid of continuum field theory, is studied by means of the notion of null Lagrangians. This notion is then used to extend the canonical 4-formalism to the boundaries established by the intrinsic non-uniqueness of the canonical tensor fields. A general representation of the null Lagrangians for the case of simultaneously 3-component and 3-dimensional field is obtained. An algorithmic approach to systematic derivation of the of null Lagrangians for an n-dimensional field is proposed. Explicit forms of null Lagrangians are given in the particular case of a coupled thermoelastic 4x4 field are considered in the framework of a hyperbolic model of the heat waves propagation! (known as GNII thermoelasticity, which can be developed from a variational principle of a Hamiltonian type.

Kudryavtseva I.A. 236
The Research of Strongly Ionized Plasma Dynamics in Near Charged Probe Region

The near-wall region of strongly ionized plasma dynamics near charged sphere-shaped probe is explored. The assumption that electrons and single-charged ions-consisted plasma parameters are influenced by Coulomb collisions is considered. To consider this influence, the model containing Fokker – Planck equation and Poisson equation is formulated. The solution method based on Monte-Carlo method is developed.

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Mathematical Model of Dynamic Problem of Micropolar Orthotropic Elastic Bars

Micropolar, asymmetrical, momental theory of elasticity, which is otherwise known as the Cosserate continuum, represents itself a strict mathematical algorithm of the field equations of elastic bodies with internal structure. The present paper is aimed at the study of the plane initial-boundary problem of micropolar theory of elasticity for orthotropic material in a thin rectangular area. Based on the generalization of the asymptotical approach, cultivated in works by S. H. Sargsyan, the one-dimensional mathematical model of the dynamic problem of micropolar orthotropic thin elastic bars is constructed. Besides the above mentioned, in the present paper depending on the values of dimensionless physical parameters of orthotropic body we investigate two variants of their values and also construct the one-dimensional models of dynamic problem of micropolar orthotropic thin elastic bars with free and constraint rotations.

The Analytical Solutions of Space Mixed Dynamical Boundary Problems for Displacements in Propagation with Constant Velocity of Stamp on Boundary of Elastic Isotrop Half Space in Presence of Wear.

The two mixed boundary problems for stamp moving along contact boundary with elastic half space by methods of integral transformations and Winner-Hopff are solved in closed integral form; it is shown that singularity of stress near edge of stamp is absent, which is the result of presence of wear between the stamp and half space.

The Analytical and Numerical Investigation of Unsteady Space Problem on Semi Infinite Stamp un Presence of Wear And Friction.

In this report two mixed unsteady plane for stamp acting on elastic isotrop half plane are solved by methods of integral transformations and Winner-Hopff. It is shown that in presence of wear on contact of stamp and half plane singularity of stress at the edge of stamp is absent. The graphs of stress along stamp and half plane contact are constructed, which allow clarify the appearance of fracture for some values of applied impulse.

The Problem of Bending of A Semi-Plates-Band under the Action of Tangential Load

In [1] the problem of generalized plane stress state of rectangular plate under the action of tangential loads, when two opposite edges is considered. The comparison between the efforts on the base of classical theory, on the base of refined theory of first order and on the base of refined theory of high order is shown. In this work the problem of bending of a semi-plates under the action of tangential load is considered. The problem of plate bending under the action of tangential loads is considered on the base of classical theory, on the base of theory of Reissner-Genki-Mindlin by Vasilyev variant and on the base of theory of Ambartsumyan. The comparisons between crosscutting forces, moments by refined theory of first-order and by higher-order refined theory are obtained.

To a Space Problem of Propagation of Elastic Waves in a Plate

In work the space problem of propagation of waves in an isotropic elastic infinite plate is considered. For definition of phase speed of a wave is received the dispersion equation. The task is investigated on the basis of a hypothesis not deformable normal and under the specified theory of plates. The limiting cases are considered: length of a wave is very great and is very small in comparison with thickness of a plate. The comparisons of meanings of the received phase speeds are carried out.

Problems of Stability for a Nonconservative Beam with Localized Mass

A beam having a fixed end and a free end on which a pressing force was exerted was considered. It was assumed that a consentrated mass was applied at the free end. Also, a few cases were considered, taking the friction into account.

The problem on the stress condition of the infinite elastic plate with a circular hole when the plate at the infinity in the horizontal direction is stretched by evenly distributed expanding forces, and the plate on the outline of the circular hole is reinforced by two identical and symmetrically arranged absolutely rigid and thin circular stringers is considered. It is required to determine the orders of the distribution of contact stresses under the stringers, the measure of their mutual hard approaching, as well as the concentration of the local normal stresses in the vertical section of the plate. This contact problem is described by the Fredholm integral equation of the first kind with Hermitian kernel, which, using Jacobi polynomials mathematical apparatus is brought to the regular infinite system. The numerical analysis of the problem is made.

At the given work the problem of determination of stress-deformable components condition of piecewise-homogeneous wedge at anti-plane deformation is investigated. The edges of it are loaded with distributed tangential forces and on the horizontal line of junction heterogeneous materials the cracks and absolutely rigid inclusion are located.

A process of gradual raising of a heavy semi-circular vault on a smooth rigid base is considered. The raising is implemented by means of continuous attachment of additional material layers to the vault external surface while its internal surface is supported by a rigid circular centering. The material used for the constructing manifests properties of creep and aging. We have formulated a linear quasistatic problem of accreted solids mechanics that describes plane deforming of the vault under gravity action during its raising and after the raising stops but the completed vault is still being supported by the centering. This problem is transformed to a boundary value problem which mathematical form matches with that of the classical problem in elasticity theory. An analytical solution of the latter problem in series is built. By means of this solution the evolution of the stress-strain state in every point of the completed vault is exposed by time integrating procedure and by solving a Volterra integral equation of the second kind. A proposition about structure of residual stresses in the completed vault after the centering removing is proved. According to the proposition these stresses can be determined as difference between the stresses corresponding to the accretion problem solved in the paper and stresses corresponding to a certain classical problem of elasticity theory with zero mass forces.

In this paper given problem of rectangular plate stability, on one edge acting compressive load. On the other edges, clear from angle of rotation and displacement, given different boundary conditions. Compressive load is “follower load”.

It is known that many problems in mechanics of continua can be treated in terms of some integral equations of the first or second kind, in which the unknown functions are highly oscillating. Numeric evaluation of such problems is based on application of various numerical methods, that means the change of initial integrals by finite-dimensional ones. However, this algorithm becomes inefficient in the high frequency range, because for more or less reliable results it is necessary to take at least ten nodes for each wavelength, which leads to algebraic systems of too large-scale dimensions. Therefore, such a type evaluations require huge computer calculation even implemented on modern computers. At the same time, integrals in such problems expressed in discrete form can be considered as a convolution of two signals that allows one to use the property of the discrete Fourier transform, also known as the convolution theorem. Thus, the Fourier transform of the unknown function is expressed as the Fourier transform of right-hand side of the integral equation and of the kernel of the integral operator. After this evaluation we only need to estimate the inverse transform to find the unknown quantity. The Fast Fourier Transform method is used to reduce significantly the time of calculation for the proposed algorithm.

About Forced Vibrations of Orthotropic Plates Freely Laying on the Rigid Substrate Subject to the Viscous Friction

The problem of definition of stress-deformed state of orthotropic plate freely laying on the rigid foundation is considered subject to the viscous friction, when on the upper plane of the plate are given: a)the normal component of displacement vector, and shear stresses are absent, b)the normal component of the stress tensor, and shear stresses are absent.

Free Vibrations of Micropolar Cylindrical Thin Elastic Shells

The research in physical and mechanical properties of solid bodies with nanocrystalic structure as well as the study of vibration processes and distributions of waves in these bodies are one of the most actual problems in the field of micropolar theory of elasticity. In this connection the study of specific features of stress-strain state and dynamic processes in the micropolar elastic bars, plates and shells gains actuality. The research in the present paper results in basic equations, boundary and initial conditions of axisymmetric dynamic problem of micropolar cylindrical shells on the basis of the general dynamic theory of micropolar thin shells. Here we also consider the problems of free vibrations of micropolar cylindrical shells on the basis of three theories: with independent fields of transitions and rotations; with constraint rotation; “with small shift rigidity”.

Diagram of a Sediment Box of Periodical Washing in Water Intake Facilities of Mountainous Rivers.

The paper deals with a sediment box periodical washing technique when water flow rate is from 0.2 to 0.5mps. From this type of sediment box removal of silt is performed in the following way. First, accumulated silt is brought to a suspended state, then washing water is let to flow which extracts the silt to the tail water or in a specially designed place. Such procedure permits reducing of washing water and washing time. The new design of the sediment box is suggested.

Bending vibrations of rectangular orthotropic plate with opposite free and rigidly restrained sides

In this work the bending vibrations of rectangular orthotropic plate with opposite free and rigidly restrained sides is considered under classical state of problem. The dispersion equations for intrinsic frequency and formulas for corresponding vibration forms are obtained. The asymptotic connections between dispersion equations of considered problem and analogical problem for orthotropic semi-infinite stripe-plate with opposite and rigidly restrained sides are revealed.

On one Problem of Differential Games of Several Players in Case of Many Goal Sets

The differential game with simple dynamics is considered, when each player has its own goal sets. The objective of each player is minimization of distance-sum of motion from the corresponding goal sets at the given instants under the most persistent counteraction of the other players. The scheme of players’ strategies construction is shown. The strategies of players and the values of functionals for each player are defined for the concrete numerical values.

Tokmajyan V., Margaryan A. 320
Requirements to Provision of Performance Reliability of Valves of <HYDROPLUS> System and Application of one of them

The paper presents possibility of increase of a reservoir useful volume using water-retaining valve of <HYDROPLUS> system and a new design of a valve supports of which are stably installed on piers has been presented.

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On Vibrations of Unmoment Non-Closed Orthotropic Circular Cylindrical Shell, When one Edge is Hinged Support and Two Boundary Generatrices are Rigid Clamped

Vibrations of unmoment non-closed orthotropic circular cylindrical shell are studied. It is supposed that one edge is hinged support and two boundary generatrices are rigid clamped. The dispersion and characteristic equations for finding the values of dimensionless characteristics of eigenfrequency and the coefficient of dumping of the corresponding vibration form are obtained. The asymptotic link between the dispersion equation of problem and analogous problem for the orthotropic rectangular plate is established.

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Numerical Analisys of Strain-Damage Coupled Problems Represented by Isostatic Co-Ordinate Net

An approach to analysis of three-dimensional static and kinematic equations of strain-damage coupled model is applied to the problem of plastic strain and damage localization near crack tips and notches. The damage is represented by a symmetric second-rank tensor, taking account of damage induced anisotropy and its effect on plastic flow. Those are evident from many experimental studies (see, for instance, the Knoop microhardness measurements along radial directions emanating the crack tip within the localized yielded zone). Modified by damage effect anisotropy Tresca yielding criterion and associated flow and damage rules are used to formulate the strain-damage coupled constitutive equations. A numerical method is then developed for computation of the principal stresses, the principal damages and isostatic net near to notches and crack tips. The problem of plastic strains and anisotropic damage localization within a neck observed in uniaxially stretched specimen is numerically analyzed.

Chakhmakhchyan R. 337
The Construction of Limited Control Which Excludes Collision of Objects Realizing Spatial Motion

In this problem is considered the system from two operated objects, which realize spatial motion and is required build limited control, providing transition of objects from arbitrary initial states in given final states at final time and excluding of the collision in process of the joint motion. Conditions are received on dynamic parameters of the system, under which delivered problem solvable for any initial and final states, satisfying assessed to restrictions.

Chlingaryan G.S. 343
An Exact Solution of one Boundary Problem for an Elastic Circular Sector

A plane contact problem for an elastic circular sector is discussed when there given normal and tangential loads in the form of symmetric concentrated forces at the arc of the circle’s boundary. There also given normal displacements and zero tangential stress on the rest part of the sector’s boundary. The solution of the problem based on decomposition of trigonometric functions and Fourier classical integral. The solution of the problem is obtained in explicit form. For the contact problem of indentation without friction of two symmetrical wedge-shaped rigid bodies on the border of circular sector the types of singularities of stresses are obtained at the top of the sector with different values of the angles of sector’s spread.

Shekyan A.L., Shekyan T.L. 348
The Contact Interaction of Elastic Disc and Punches Through Thin Friction Elastic Lower

A plane contact problem, when two symmetric distributed punches to press on elastic discs is considered. To the punch is connecting with elastic thin lower with too friction properties. Elastic