

## ABSTRACTS

**Section of «Mechanics of deformable solids, mechanics of fluids, gas and plasma»**

UDC 539.3 Galishin A.Z., Steblyanko P.A., Shevchenko Yu.N. THERMAL STRESS-STRAIN STATE OF THIN LAMINATED SHELLS OF REVOLUTION UNDER CONVECTIVE HEAT EXCHANGE WITH THE ENVIRONMENT. The technique for determination of axisymmetric thermoelastoplastic stress-strain state of thin laminated shells in situations of convective heat transfer to the environment is elaborated. The technique is based on relations of the theory of thin shells with consideration of transverse-shear and torsion strains. As the constitutive equations the relations of the theory of the deformation processes along the trajectories of a small curvature are used. Temperature field of the layered shell is determined by solving the time-dependent heat conduction problem. Physical and mechanical properties of the materials are assumed to depend on temperature. The problem of thermoplasticity is reduced to the numerical integration of ten-order system of differential equations in each approximation of an arbitrary loading step. For integration of this system the Runge-Kutta's method with Godunov's discrete orthogonalization is used. The heat conduction problem is solved using the finite difference method and explicit difference system with respect to time. As an example the thermoelastoplastic stress-strain state of two-layered goffered shell is considered.

*Keywords:* thermoelastoplastic stress-strain state, two-layered goffered shell, temperature field.

UDC 539.374 Babeshko M.E., Savchenko V.G. INVESTIGATION OF EFFECT OF ANNEALING TEMPERATURE OF SHEET STEEL 25 X7CA ON THE STRENGTH OF PRESSURE VESSEL. The method for the numerical determination of the failure load of thin-walled structural element as shells of revolution loading the increasing internal pressure is elaborated. The developed by authors methods for solving of boundary value problems of plasticity with the known strength criteria are used. It is shown that the failure load of the structural element is essential dependent on the annealing temperature of the material.

*Keywords:* the failure load, the strength criteria, the boundary value problems of plasticity.

UDC 539.3 Zelensky V. S., Bystrov V.M., Dekret V.A INFLUENCE OF GEOMETRICAL PARAMETERS OF THE LAYERED RECTANGULAR PLATES ON THE CRITICAL LOAD, IN AXIAL COMPRESSION. Discussed the spatial problem of stability of layered rectangular plate under uniaxial compression. The dependence of the critical load of the length of the plate at the various values of the parameter thin-walled. For the decision of tasks of applied three-dimensional linearisation the theory of stability of deformable bodies.

*Keywords:* rectangular plate, linearisation the theory of stability, the uniaxial compression.

UDC 539.3 Panasiuk O. M. NUMERICAL ANALYSIS OF THE QUASI-SHEAR WAVES PROPAGATION IN PRESTRESSED INCOMPRESSIBLE COMPOSITE MATERIAL. The dispersion equation for quasi-shear waves propagated along the layers of a prestressed incompressible composite material is analyzed numerically. The effect of the prestresses on the wave velocity is studied.

*Keywords:* laminated composite material, prestresses, quasi-shear wave, quasi-transverse waves.

UDC 534.075 Dovzhyk M. V., Nazarenko V. M. FRACTURE OF A HALFSpace COMPRESSED ALONG NEAR-SURFACE CRACK, WHEN DISTANCES BETWEEN A FREE SURFACE AND A CRACK PLANE IS SMALL. For a halfspace with near-surface penny-shaped cracks the critical parameters of fracture for very small distances between cracks are calculated. For these problems the criteria of applicability of the approximate design model both concerning parameter thin-walled and concerning boundary conditions used in approximate design model are founded.

*Keywords:* compression, halfspace, near-surface crack, critical stress.

UDC 519.6 Tonkonog E. A., Khudaya Zh. V., Steblyanko P. A. ULT UPON SPLINES SOLVING SIMULATES THE MOTION WITH VISCOUS FRICTION. This article examines the spline method for solving problems, which is a model of the body with viscous friction. With increasing speed, the resistance decreases, and when the speed reaches a certain point the situation changes. Speed starts to fall, and the force of resistance begins to increase. Model of the process described is Cauchy for linear second order differential equation with variable coefficients, characterizing the state of a dynamic object.

*Keywords:* model, collocation method, Cauchy problem, spline.

UDC 629.02 Sasov A.A., Kulshenko V.V. INVESTIGATION OF THE COMPONENTS OF AGGRESSIVE ENVIRONMENT ROADWAY CORROSION BOTTOM AND ELEMENTS BUS BODIES. Theoretical premises of conservability of body bottoms of buses providing are given, the points of corrosion of ferrouse metals and its influence on a lifetime of items, appearance and development atmospheric corrosion on the opened surfaces and under drapes are studied, the estimation method of adequacy of sought-for dependences at Kohren, Fisher, and Student criteria is applied.

*Keywords:* corrosion, body bottoms of buses, method of adequacy.

UDC 539.3 Bogdanov S. Yu. SOME APPLICATIONS OF GENERALIZED FUNCTIONS IN THE DYNAMICS OF STIFFENED CYLINDRICAL SHELLS. System of motion equations stiffened cylindrical shell with coefficients as  $\delta$  - function and its derivations, depends from coordinates is implicated. Correctness of expansion classical dynamical problem for stiffened cylindrical shell is performed. This system maybe used for solution motion equation stiffened shell as rigid, as motion contacts edges with shell.

*Keywords:* cylindrical shell, dynamical problem, motion equation.

UDC 539.3 Baschuk O. Yu. THE PLANE PROBLEM OF THREE – DIMENSIONAL STABILITY OF THE RIGIDLY CLAMPED PLATE WITH CENTRAL CRACK. The plane problem stability of an isotropic plate with a central crack is considered within the framework an exact approach. The plate is rigidly clamped and compressed along the crack by a surface load of permanent intensity. The approximate solution of the problem is based on the next approach. The effect of the mechanics and geometric characteristics of the plate on behaviour of critical factors is investigated. critical load from two parameters – the length of crack and thin-walled parameter is investigated.

*Keywords:* three-dimensional stability, inhomogeneous initial state, central crack, net approach.

UDC 539.3 Baschuk O. Yu. THE DEPENDENCE OF CRITICAL LOAD FROM THE GEOMETRICAL CHARACTERISTIC OF THE RIGIDLY CLAMPED PLATE WITH CENTRAL CRACK. The plane problem of three-dimensional stability of the rigidly clamped plate with central crack at uniaxial loading along the crack is considered. The approximate solution of the problem is obtained by the variation– difference method. The dependence of critical load from two parameters – the length of crack and thin–walled parameter is investigated.

*Keywords:* three-dimensional stability, central crack, variation– difference method.

UDC 539.3 Majborodina N.V., Mejsh V.F., Gerasimenko V.A. EFFECT OF LOCATION REINFORCED BY TRANSVERSE RIBS ON THE STRESS - STRAIN STATE ELLIPSOIDAL SHELLS OF AN UNSTEADY AT LOAD. The statement of problems of forced nonaxisymmetric vibrations of transversal supported ellipsoidal shells under nonstationary loads with using geometrically nonlinear theory is presented. A numerical algorithm of solving is constructed and an analysis of obtained results is given.

*Keywords:* ellipsoidal shell, nonlinear theory, nonstationary loads, numerical algorithm.

UDC 539.3 Anikyev I.I., Maksimjuk V.A., Mihaylova M.I., Sushchenko E.A. EXPERIMENTAL RESEARCH METHODOLOGY STRAIN CANTILEVER PLATE WITH REINFORCING ROD AT SHOCK WAVES. The article is devoted to experimental research of straining process of the tied-up system. The system consists from cantilever plate and supporting bar and are elastic deformation at falling the long flat shock wave of acoustic rang on the cantilever plate. Registration of the time - dependent deformations was conducted on the personal computer with use of fast-acting 4 – channel input – output and treatment of analog and digital information of L 1250 (Russia); and also high-fidelity portable 8 – channel apparatus of Mobile SCADAS LMS (Belgium).

*Keywords:* cantilever Plate, supporting Bar, elastic Strain, shock Wave.

UDC 681.3 Degtiar S.V., Degtiar V.G. STABILITY ANALYSIS OF SOLUTION FAMILY OF THE SYSTEM OF DIFFERENTIAL EQUATIONS WITH RANDOM RIGHT-HAND. The asymptotic behavior of solutions of linear differential equation systems is investigated for the cases, when their coefficients depend on semi-markov processes with calculable sets of states.

*Keywords:* random process, the expectation, the total probability, the column vector, Markov process.

UDC 539.3 Babich S.Yu., Degtiar S.V., Kulik A.B., Shchekan N.P. MIXED PROBLEM FOR TWO LAYERS WITH INITIAL STRESSES. An influence of the initial stresses on the basic characteristics of the contact interaction and on the stress intensity factor in the mixed problems for a prestressed layer is investigated.

*Keywords:* the initial stresses, the contact interaction, mixed problem.

UDC 517.5 Derets E. V. ABOUT APPROACH BY LINEAR POSITIVE POLYNOMIAL OPERATORS OF CLASSES OF FUNCTIONS DETERMINED BY INTEGRAL MODULUS OF CONTINUITY. The error of the approximation of classes  $W^r H_1^\omega$  periodic differentiable functions by linear positive polynomial operators for even  $r \geq 6$  and any convex modulus of continuity  $\omega(t)$  is obtained.

*Keywords:* the approximation, polynomial operators, convex modulus of continuity.

UDC 517.5 Davidchuk A.N. APPROXIMATION OF FUNCTIONS OF TWO VARIABLES. Asymptotically exact constants in Jackson approximation of functions of two variables by Fejer.

*Keywords:* approximation of functions, constants, Jackson, Fejer sums.

UDC 539.375:622.35 Lugovy P. Z., Prokopenko N. Y., Golovko K. G. MODELLING THE ACTION OF IMPACT MECHANICAL EQUIPMENT LOADING WEDGE-SHAPED ELEMENT. The experimental modelling the action of the loading wedge-shaped element is carried out and influence of loading distribution on the hole contour with use the bushes is revealed. At the presence of bushes the ratio of deformation in the planning split point to the axisymmetric deformation coincides practically with the ratio of hole perimeter length to the bushes length that is verified by theoretical calculations.

*Keywords:* wedge-shaped element, bush, hole, impact loading, deformation.

UDC 539.3 Oksenchuk N.D. NUMERICAL SIMULATION OF SURFACE HARDENING HALF-SPACE WITH IMPULSE THERMOMECHANICAL LOADING TAKING INTO ACCOUNT MICROSTRUCTURAL TRANSFORMATION. This paper assesses the strengthening of mechanisms that occur during thermomechanical loading pulse half-space. Thus in addition to the transformation volume change is taken into account the dependence of the inelastic characteristics of the phase composition of the material at the microstructural transformations (SMEs) and temperature changes. The developed model provides a quantitative and qualitative effects of phase composition on the inelastic properties of the material, namely the level of transformation hardening, which at the given load parameters significantly greater than the deformation.

*Keywords:* pulse thermomechanical loading, transformation hardening, microstructural transformation.

UDC 539 Steblianko P.A., Kravchuk T.V. CONSTRUCTION AND ANALYSIS OF SURFACE CONNECTIONS BUILT WITH THE HELP OF TWO-DIMENSIONAL SPLINE FUNCTIONS. In this paper, we analyzed the methods of spline functions for their suitability for use in interpolation problems in the construction of surfaces. It was compiled interpolation formula for constructing surfaces. Studies were performed on the docked surfaces constructed using spline functions, showed that the maximum value of the gap between these surfaces is less than 0.0001% which indicates that the spline function is an excellent method of interpolation surfaces.

*Keywords:* spline function interpolation problem, docked surface.

UDC 539.3 Ignatishin I.M., Babich S. J. RESEARCH RESPONSE QUENCHER MECHANICAL VIBRATIONS BY THE FORMULA VIET. In this work the parameters of pendulum and cylindrical quenchers mechanical vibrations using trigonometric formulas Viet is considered. Analytical formulas for the resonant quencher frequency is obtained. Optimization parameters quencher mechanical vibrations at the stage of design to ensure effective methods of fighting external perturbations is used.

*Keywords:* mechanical quencher, frequency response, formulas Viet, optimization.

UDC 517.5 Derets E. V. ABOUT AN OPTIMAL INTERVAL QUADRATURE FORMULA ON A CERTAIN CLASSES OF PERIODICAL DIFFERENTIABLE FUNCTIONS. The optimal interval quadrature formula in the class of functions with convex majorant of the modulus of continuity of first derivative for increase and decrease is obtained. Intervals of integrations of quadrature formulae are nonintersecting.

*Keywords:* interval quadrature formula, modulus of continuity, intervals of integrations.

UDC 536:669.02.09:669.054.82:669.18:536.001:005 Voloshin R. V., Pavluchenkov I.A., Salo E.V., Voloshin V.F. ALGORITHMS FOR CALCULATING MELTING PROCESS CHEESE DIOXIDIZERS FORM USING CURVILINEAR GRID (ALONG THE RADIUS R AND ANGLE) IN THE STEEL LADLE. The algorithm of calculation, describing the thermophysical picture scavenger melting cylindrical shape using a curvilinear grid (the radius  $r$  and angle) in the ladle.

*Keywords:* steel ladle, scavenger, the process of melting.

UDC 539.3 Ljashenko Ja.G. NONLINEAR DEFORMATION CHARACTERISTICS POLYMER COMPOSITE MATERIALS WITH SPHEROIDAL INCLUSIONS. The problem of nonlinear deformation of composite material, consisting of the polymer matrix and spheroidal inclusions or pores is considered. The behavior of the inhomogeneous medium is depend on the concentration and size of inclusions and mikrodamage. Polymers under stress exhibit nonlinear deformation, time-dependent. Fractional exponential operators are used when describing creep curves. Its operators allow consideration of the impact load history, time and other factors.

*Keywords:* nonlinear deformation, fractional exponential operators, composite material.

UDC 539.3 Lugovoy P. Z., Prokopenko N. Y., Golovko K. G. DISPERSION CURVES OF HARMONIC WAVES PROPAGATING ALONG LONGITUDINALLY REINFORCED CYLINDRICAL SHELLS ON ELASTIC FOUNDATION. The influence of discrete arraignment of ribs and Wincler coefficient of elastic foundation on the number and shape of dispersion curves of the waves propagating along the cylindrical shell reinforced with longitudinal ribs are studied. The variable cases of shell deformation are examined: the common case when ribs are bended and are twisted; case, when ribs are bended only and case when ribs are twisted only. The results of carried out investigation the influence of Wincler elastic foundation coefficient on the wave parameters show that with growth of this coefficient the blocking frequencies increase and the shape of dispersion curves is changed.

*Keywords:* cylindrical shell, longitudinal ribs, harmonic waves, dispersion curves, blocking frequencies, Wincler elastic foundation.

UDC 539.3 Mejsh Yu.A. THE DYNAMIC BEHAVIOR OF DISCRETELY STIFFENED CYLINDRICAL SHELLS ON ELASTIC FOUNDATION UNDER UNSTEADY LOADS. The problem of forced vibrations of a cylindrical shell reinforced by discretely ribs on elastic foundation under an distributed loading. The dynamic behaviour of nonhomogeneous cylindrical shell is considered in the framework of the shells and rods Timoshenko type theory. To solve the problem using the method of finite differences in the spatial and the time coordinates. The numerical results of the solution are obtained.

*Keywords:* cylindrical shell, method of finite differences, numerical result.

UDC 539.3 Kovalenko A.P. BUILDING OF MATHEMATICAL MODEL OF INVESTIGATION OF TRANSIENT PROCESSES IN SYSTEM ELASTIC PIPELINE WITH LIGUID UNDER LONGITUDINAL DYNAMICAL SHOCK LOADING. Mathematical model of investigation of transient procecces in a pipeline with a liquid under longitudinal shock dynamical loading is building. Characterial coefficiens of hydroelastisity of system is find.

*Keywords:* mathematical model, a pipeline with a liquid, dynamical loading.

UDC 579.61:616-073 Meshchaninov S.K. SYNERGETIC MODEL ASSESSMENT OF THE RELIABILITY OF EQUIPMENT FOR BIOMEDICAL RESEARCH. There are proposed estimation synergetics model of reliability functioning of equipment for carrying out medical and biologic researches. The model is based on representation about a complex of equipment for medical and biologic researches, as a complex technical system consisting of consistently connected elements.

*Keywords:* synergetics, reliability, probability, patient, refuse, complex technical system.

UDC 539.3 Bashchuk E.Yu., Bystrov V.M., Zelensky V.S. NUMERICAL INVESTIGATION OF STABILITY OF A PLATE WITH A CENTRAL CRACK AT UNIAXIAL COMPRESSION. The numerical decision of stability problem of rectangular plate with central crack under uniaxial pressing was obtained. The dependence of the critical load and the form of the loss of stability of a plate from the length of the crack was investigated. The static method of three-dimensional theory of stability was applied to the problem decision.

*Keywords:* rectangular plate, central crack, uniaxial compression, the three-dimensional linearized theory of stability.

UDC 539.3 Meysh V.F., Arnauta N.V. USE OF APPROXIMATION RICHARDSON FOR NUMERICAL SIMULATION OF THE DYNAMIC BEHAVIOR MULTILAYER DISCRETELY BACKED CYLINDRICAL SHELLS AT NONSTATIONARY LOADING. The paper studies construction of numerical algorithm for solving dynamic problems of multi-layered discrete stiffened cylindrical shells with using Richardson type finite differences approximation. The numerical results of the solution are obtained.

*Keywords:* cylindrical shell, dynamic problem, finite differences approximation.

UDC 539.3 Chervinko O. P., Dolya E. V., Yakimenko N. S. THERMAL FATIGUE FAILURE OF LAYERED VISCOELASTIC RECTANGULAR PRISM UNDER HARMONIC LOADING. The thermal fatigue failure of rectangular prism under harmonic compression within a coupled problem of thermoviscoelasticity is investigated. The problem is solved by FEM. For polymeric prism the possibility of surface failure is established, whereas in laminated structure the inner lays of polymer will fail.

*Keywords:* viscoelastic rectangular prism, thermal fatigue failure, harmonic compression.

UDC 539.3 Senchenkov I.K., Chervinko O.P., Ryabtsev I.A. NUMERICAL MODELING SSS AND MICROSTRUCTURE STATE OF HOT ROLLING ROLL UNDER MULTILAYER SURFACING AND OPERATIONAL PROCESS. The method of calculation of residual surface and following operation stresses in hot rolling roll is developed. Amplitude and mean values of stress-strain state, that are necessary for evaluation of fatigue endurance of parts, are calculated.

*Keywords:* rolling roll, multilayer surfacing, residual stresses and microstructure, endurance of surfacing parts.

UDC 539.3 Levchenko V.V., Mekievskii O.I. ELECTROELASTIC VIBRATIONS OF PIEZOCERAMIC CIRCULAR PLATES WITH RADIAL CUTS ELECTRODES. The electroelastic vibrations of piezoceramic circular plates with radial cut electrode coverage are investigated. The natural frequencies and mode shapes for the first harmonics in the circumferential coordinate are identified. The dependence of the eigenfrequencies on the number of cuts and geometry is analysed.

*Keywords:* circular piezoceramic plate with radial cuts electrodes, the natural frequencies and forms of electroelastic vibrations.

UDC 517.977 Zaytsev V.G., Pyshnyy M. A. SUPPRESSION OF NOT MEASURED INDIGNATIONS IN TECHNICAL PROBLEMS OF CONTROL. In article it is offered to use method AKAR for the decision of the problems connected with suppression of indignations of environment. The case when they can't be measured or suppressed in other ways is considered. Possibilities of a method and feature of its realization are shown by the resulted example. References 6.

*Keywords:* control, suppression, indignations, AKAR method.

UDC 621.774.353.004 Ilchenko N.G., Bezzhinny I.I., Volosova N.N. IMPROVING THE PROCESS OF STRAIGHTENING PREPARATIONS CARLOAD AXES TO THE PRESS. A new flowsheet editing pieces make that better corrects the curvature of the workpiece and allows you to get a piece of the guaranteed maximum permissible curvature.

*Keywords:* blank Curvature, straightening, flowsheet.

### **Section of "Theory and methods of teaching mathematics, mechanics and informatics"**

UDC 372.851 Krylova T.V., Gulesha E.M. OF INFORMATIVE-COMMUNICATION TECHNOLOGIES ARE IN THE EDUCATIONAL PROCESS OF HIGHER SCHOOL. Classification of educational setting software is in-process resulted, the basic requirements are formulated to him. A brief review and analysis of the most well-known computer teaching environments, such, as electronic textbooks, teaching program, databases and base of knowledges, electronic facilities of teaching, system of analytical calculations of Maple, system of computer algebra of MATLAB, computer trainers, supervisory the programs, programmatic-methodical complexes, are formulated is given. References 6.

*Keywords:* educational setting software, electronic textbooks, teaching program, databases and base of knowledges, programmatic-methodical complex.

UDC 519: 378.147 Nikulin A.V. MULTILINGUALISM IN EDUKOLOHIYI HIGHER MATHEMATICS. There are experienced the process of developing and implementing the important components of the academic process of higher mathematics on a base of the systems approach and education science in two terminological systems and there are generalized the experience of concluding appropriate dictionaries and reference books.

*Keywords:* terminological system, appropriate dictionaries, higher mathematics,

UDC 517.2 Vyshenska O.V., Meish Y.A. DIAGNOSTIC - CORRECTION TO TEST FOR STUDYING THE FUNDAMENTAL CONCEPTS ANALYSIS. The paper considered diagnostic – remedial tests for studying the fundamental concepts of analysis. In particular, consider the concept of numerical sequence boundary and discuss one of the possible methods

of learning this concept. The typical examples of tests with commentaries and interpretations of the definition of sequence boundaries are presented.

*Keywords:* diagnostic – remedial tests, numerical sequence boundary.

UDC 517.2 Belova M.A., Gladka Yu.A., Maschenko L.Z. PERSPECTIVE METHODS OF TEACHING HIGHER MATHEMATICS IN HIGH SCHOOLS, AIMED AT SKILLS DEVELOPMENT AND FORMING OF SCIENTIFIC VIEWS OF STUDENTS. This paper presents the most perspective techniques of teaching higher mathematics in universities. The possibilities of using information technologies, intensification of training, applied orientation of teaching mathematics and individually differentiated approach during teaching students are theoretically proven.

*Keywords:* information technologies, teaching methodology, applied orientation, higher mathematics.

UDC 517.31 (075) Motorina V.G. Syzonenko E.Y. LOGICAL CONTENT ANALYSIS STUDY - DESIGN BASIS OF MATHEMATICS EDUCATION. University (theoretical aspects). Logical analysis is the basis for the design of technology university teaching mathematics, a means of structuring and systematizing knowledge offered to students. Knowledge of the basic components are the mathematical knowledge for teacher reference further into theorems, proof of concepts in any subject area. The teacher who has a methodology of analysis is able to improve the learning of mathematics in general. A scheme enable teachers to identify the most important concepts to critically evaluate the role of specific concepts in the overall scheme and make possible permutation, the redistribution of concepts according to their importance in the logical structure of the educational material.

*Keywords:* technology training, methodology, study material.

UDC 517.31(075) Vodolazhenko A.V., Syzonenko Y.U. CONCEPT MAPS - PRINCIPLES OF ELECTRONIC REFERENCE TOOL. Concept maps can be used as a basis for the creation of electronic reference books through the use of structuration of visual presentation of educational material, complete with hypertext links gives up and further export in the form of web pages. In this paper, the concept maps were created using the IHMC CmapTools, allowing to develop complex schemes.

*Keywords:* concept maps, training materials, electronic guidebooks.

UDC 517.925 Zahariychenko L.I., Zahariychenko Yu.O. QUALITATIVE THEORY OF DIFFERENTIAL EQUATIONS: WHERE DO I START? The course “Qualitative theory of differential equations” should start with a multidisciplinary tasks that test knowledge, understanding, skills, and the same time preparing students for new mathematical abstractions. The article gives examples of such problems, consider their decision and suggested questions for discussion in the lectures.

*Keywords:* differential equations, multidisciplinary tasks.