MATHEMATICS, MECHANICS

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ANALYSIS OF AXISYMMETRIC PROBLEM OF ELASTICITY THEORY FOR INHOMOGENEOUS TRANSVERSALLY-ISOTROPIC CONIC SHELL

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Akhmedov Natik Karakishi-ogly − Doctor of Mathematical Science, Professor, Department of Mathematical Methods of Applied Analysis, Faculty of Applied Mathematics and Cybernetics, Baku State University, Z. Khalilov St., 23, Baku, AZ-1073/1, Azerbaijan, e-mail: anatiq@gmail.com

Mekhtiev Magomed Farman-ogly − Doctor of Physical and Mathematical Science, Professor, Academician, Institute of Mathematics and Mechanics of NAS of Azerbaijan, B. Vakhabzade St., 9, Baku, AZ-1141, Azerbaijan, e-mail: mehtiev_magomed@mail.ru

Shakhverdieva Gyulnaz Nariman-kyzy – Lecturer, Department of Mathematics and Informatics, Baku Slavonic University, S. Rahimov St., 145, Baku, AZ-1141, Azerbaijan, e-mail: bgnq@mail.ru

By the method of asymptotic integration of elasticity theory equations, an axisymmetric problem of elasticity theory for an inhomogeneous transversally-isotropic conic shell is studied. Inhomogeneous and homogeneous solutions are constructed. Behavior of the solution of the obtained boundary value problems both in the internal part of the shell and near its edges is studied. The peculiarities of the stress-strain state of a variable thickness inhomogeneous transversally-isotropic conic shell are revealed.

Keywords: *inhomogeneous solutions, homogeneous solutions, edge effect, boundary layer, anisotropy, asymptotic method.*

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INFLUENCE OF THE NANOPARTICLES ON THE HEAT TRANSFER IN THE MARANGONI BOUNDARY LAYER AT THE EXTERNAL FLOW

© 2015 V.A. Batishchev, Yu.S. Nikolaenko, A.S. Piskunov

Batishchev Vladimir Andreevich – Doctor of Physical and Mathematical Science, Professor, Department of Theoretical and Computer Fluid Dynamics, Institute of Mathematics, Mechanics and Computer Sciences of the Southern Federal University, Milchakov St., 8a, Rostov-on-Don, 344090, Russia, e-mail: batish@math.sfedu.ru.

Nikolaenko Yurii Sergeevich − Post-Graduate Student, Institute of Mathematics, Mechanics and Computer Sciences of the Southern Federal University, Milchakov St., 8a, Rostov-on-Don, 344090, Russia, e-mail: yur-nikolaenko@yandex.ru

Piskunov Andrei Sergeevich − Master Student, Institute of Mathematics, Mechanics and Computer Sciences of the Southern Federal University, Milchakov St., 8a, Rostov-on-Don, 344090, Russia, e-mail: vnikaget@gmail.com

Calculated heat flux at the free fluid surface with nanoparticles. Fluid flow caused by the nonuniform heating of the free boundary when the boundary is cooled at a distance from the axis of symmetry. It is shown that in the planar case the heat flux increases with increasing speed of the external flow and with increasing concentrations of nanoparticles. However, for certain types of nanoparticles at low external flow velocity the heat flux may either decrease or increase with increasing concentration of nanoparticles.

Keywords: *nanoparticles, effect of Marangoni, free surface, boundary layer, outer stream.*

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THE ALGORITHM FOR DETERMINING THE MINIMA OF THE *N*-DIMENSIONAL BERNSTEIN LATTICE OVER RATIONAL FUNCTION FIELDS $F_{2^m}(x)$

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Deundyak Vladimir Mikhailovich – Candidate of Physical and Mathematical Science, Senior Researche, NII «Specvuzavtomatika», Gazetny Lane, 51, Rostov-on-Don, 344002, Russia; Associate Professor, Department of Algebra and Discrete Mathematics, Institute of Mathematics, Mechanics and Computer Sciences of the Southern Federal University, Milchakov St., 8a, Rostov-on-Don, 344090, Russia, e-mail: vlade@math.sfedu.ru

Chekunov Evgeniy Sergeevich − Master Student, Department of Algebra and Discrete Mathematics, Institute of Mathematics, Mechanics and Computer Sciences of the Southern Federal University, Milchakov St., 8a, Rostov-on-Don, 344090, Russia, e-mail: echekunov@gmail.com

The problem is considered of finding the minima of n-dimensional Bernstein lattice over rational functional fields $F_{2^m}(x)$. *The solution is based on the Lenstra lattice basis reduction algorithm. For n-dimensional Bernstein lattice it is proved the existence of a minima element and its connection with the Lenstra reduced basis. An algorithm for solving the problem and the proof of correctness are presented. The result is applied in the mathematical model of Bernstein list decoder and it is used to enhance the protection of McEliece-like code-based cryptosystems.*

Keywords: *n-dimensional lattices, lattice minima, Bernstein list decoding algorithm, LLL algorithm.*

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TORSIONAL OSCILLATION OF REVOLUTION SHELLS WITH COMPLICATED SHAPE OF MERIDIAN

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Makarov Sergei Sergeevich − Post-Graduate Student, Department of Theory of Elasticity, Institute of Mathematics, Mechanics and Computer Sciences of the Southern Federal University, Milchakov St., 8a, Rostov-on-Don, 344090, Russia, e-mail: makarov-sergey-rostov@mail.ru

Ustinov Yurii Anatolevich − Doctor of Physical and Mathematical Science, Professor, Department of Theory of Elasticity, Institute of Mathematics, Mechanics and Computer Sciences of the Southern Federal University, Milchakov St., 8a, Rostov-on-Don, 344090, Russia, e-mail: ustinov_rsu@mail.ru

Developed the research methods of natural torsional oscillation for revolution shells with complicated shape of meridian and variable thickness. Investigated influence of parameters describing a variable thickness along the axis of the shell, on the natural frequencies and mode shapes for cylindrical shell on the basis of the developed algorithms. Constructed dependences to the first and second natural frequencies on the amplitude of the convexity (concave) for shells with convex and concave meridian.

Keywords: *shell of revolution, torsional oscillation, variable thickness.*

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MODELING OF THE VERTICAL MARKETING SYSTEM UNDER CORRUPTION

© 2015 A.E. Nazirov, A.B. Usov

Nazirov Adalyat Elshanovich – Post-Graduate Student, Department of the Applied Mathematics and Programming, Institute of the Mathematics, Mechanics and Computer Sciences of the Southern Federal University, Milchakov St., 8a, Rostov-on-Don, 344090, Russia, e-mail: carma@mail.ru

Usov Anatolii Borisovich – Doctor of Technical Science, Associate Professor, Department of the Applied Mathematics and Programming, Institute of the Mathematics, Mechanics and Computer Sciences of the Southern Federal University, Milchakov St., 8a, Rostov-on-Don, 344090, Russia, e-mail: usov@math.sfedu.ru

An original mathematical model, that describes different activities of actors in the vertical marketing system is presented. There are a provider, a mediator, a trading enterprise are presented as a controlling subjects. The relationship between provider and mediator accords to commission agreement. Trading enterprise sells products is produced by the provider. The model is based on the game-theoretical and hierarchical approach. A Stackelberg equilibrium in terms of sustainable development is established under possible corruption. The method of impulsion is used as a method of hierarchical control to solve this model. A number of typical examples followed by an interpretation of the results obtained are presented. Some contributions to fight corruption in three-level system are made.

Keywords: *hierarchy, three-level control system, method of impulsion, Stackelberg's equilibrium, corruption, computing simulation.*

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CONTACT PROBLEMS FOR A COMPOSITE HALF-SPACE

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Pozharskii Dmitrii Aleksandrovich – Doctor of Physical and Mathematical Science, Professor, Head of Applied Mathematics Department, Don State Technical University, Gagarin Sq., 1, Rostov-on-Don, 344000, Russia, e-mail: pozharda@rambler.ru

Poltinnikov Viktor Ivanovich − Associate Professor, Applied Mathematics Department, Don State Technical University, Gagarin Sq., 1, Rostov-on-Don, 344000, Russia.

The integral equations are derived for three-dimensional contact problems for an elastic half-space consisting of two wedge-shaped layers with sliding support in between. The wedge-shaped layer joined to the layer in contact with a punch is incompressible (rubber-metal conjunction). The outer face of this layer is supposed to be stress-free or subjected to sliding support. To solve auxiliary boundary-value problems for a given normal load the method of Fourier and Kontorovich – Lebedev complex integral transformations is used. These auxiliary problems are finally reduced to systems of Fredholm integral equations of the second kind, solutions of which go into the kernels of the integral equation of the contact problems. For solving the contact problems the Galanov's method is used.

Keywords: *contact problem, composite half-space, wedge.*

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ON INTERRELATION OF CONTINUITY MODULES WITH SIGN-SENSITIVE WEIGHT OF CONTINUOUS FUNCTION ON SEGMENT

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Ramazanov Abdul-Rashid Kekhrimanovich − Doctor of Physical and Mathematical Science, Professor, Head of Department of Mathematical Analysis, Dean of the Faculty of Mathematics and Computer Science, Dagestan State University, Gadzhiev St., 43a, Makhachkala, DR, 367000, Russia; Main Researcher, Dagestan Scientific Centre of Russian Academy of Sciences, Gadzhiev St., 45, Makhachkala, DR, 367025, Russia, e-mail: ar-ramazanov@rambler.ru

Magomedova Vazipat Gusenovna − Candidate of Physical and Mathematical Science, Associate Professor, Department of Mathematical Analysis, Dagestan State University, Gadzhiev St., 43a, Makhachkala, DR, 367000, Russia; Department of Mathematics, Dagestan State Institute of National Economy, Ataev St., 5, Makhachkala, DR, 367008, Russia, e-mail: vazipat@rambler.ru

Ibragimova Bella Muslimovna − Senior Lecturer, Department of Mathematics, Dagestan State Institute of National Economy, Ataev St., 5, Makhachkala, DR, 367008, Russia, e-mail: i.bella22@mail.ru

For modulus of continuity of arbitrary degree of function continuous on segment in metrics of signsensitive weight estimation over modulus of continuity of the next degree is given. In addition, other modules of continuity with signsensitive weight are constructed and the estimation establishing relation for their arbitrary degrees is obtained. Both estimations obtained in the work generalize on metrics of signsensitive weight classical Marchaud inequality for uniform modules of continuity, which has wide application in approximation theory, in theory of embedding classes of functions and in other sections of mathematics.

Keywords: *modulus of continuity, modulus of smoothness, signsensitive weight, continuous functions, Marchaud inequality, classes of functions, embedding theorems.*

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THE EXISTENCE OF THE WEAK SOLUTIONS OF MARGURRE-VLASOV MODELS FOR TERMOELASTIC OSCILLATIONS OF SLOPING CASINGS WITH THE WEAK INERTIA OF THE LONGITUDINAL TRANSFERS

© 2015 г. V.I. Sedenko, T.V. Bogachev, T.V. Alekseichik

Sedenko Vasilii Igorevich − Doctor of Physical and Mathematical Science, Professor, Head of Department of the Fundamental and Applied Mathematics, Rostov State Economic University, B. Sadovaya St., 69, Rostov-on-Don, 344002, Russia, e-mail: visedenko@mail.ru

Bogachev Taras Viktorovich – Candidate of Physical and Mathematical Science, Associate Professor, Department of the Fundamental and Applied Mathematics, Rostov State Economic University, B. Sadovaya St., 69, Rostov-on-Don, 344002, Russia, e-mail: bogachev73@yandex.ru

Alekseichik Tamara Vasil'evna – Candidate of Econimic Science, Associate Professor, Department of the Fundamental and Applied Mathematics, Rostov State Economic University, B. Sadovaya St., 69, Rostov-on-Don, 344002, Russia, e-mail: alekseychik48@mail.ru

In this paper prove the theorem of existence of weak solutions Marguerre - Vlasov's models with the evolution of the heat, the inertia of the turn of the casing's point, the inner friction in the casing. It define the approximation of Bubnov - Galerkin. It prove the local existence the system of partial differential equations for time coefficients of approximation. We study it differential properties. We prove with the energetic correlation the existence of approximation for the every section of a time and the existence of the equilibriums valuations of the approximation, which helps to prove integral correlations, defined of the weak solutions.

Keywords: *termoelastic, weak solutions, global in time estimates, weak compactness, strong compactness, differential properties.*

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MAXIMUM FLOW PROBLEM IN NETWORKS WITH LOSSES AT THE VERTICES

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Skorokhodov Vladimir Aleksandrovich − Candidate of Physical and Mathematical Science, Associate Professor, Institute of Mathematics, Mechanics and Computer Sciences of the Southern Federal University, Milchakov St., 8a, Rostov-on-Don, 344090, Russia, e-mail: pdvaskor@yandex.ru

Shevelev Maksim Valer'evich – Student, Institute of Mathematics, Mechanics and Computer Sciences of the Southern Federal University, Milchakov St., 8a, Rostov-on-Don, 344090, Russia, e-mail: maximka.shevelyov@yandex.ru

We consider a network with some properties: each vertex has an additional characteristic - quantity flow losses. The peculiarity of such networks is that due to loss in some vertexes, the value of the flow is coming from the source can be not equal to the flow entering into the target. For such networks, the problem of maximizing of losses and the problem of minimizing of losses are considered. Algorithms of their decision are developed for each of the offered problems.

Keywords: *oriented networks, flows in networks, maximal flow, losses of flow, maximizing of losses, minimizing of losses.*

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QUADRATURE FORMULAS FOR SINGULAR INTEGRALS WITH NEARLY GAUSSIAN DEGREE OF ACCURACY

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Khubezhty Shalva Solomonovich – Doctor of Physical and Mathematical Science, Professor, Department of Mathematical Analysis, North Ossetian State University, Vatutin St., 46, Vladikavkaz, 362025, Russia; Leading Researcher, Southern Mathematics Institute of VSC RAS and the Government of the Republic of North Ossetia-Alania, Marcus St., 22, Vladikavkaz, 362027, Russia, e-mail: shalva57@rambler.ru

Tsutsaev Arsen Olegovich − Post-Graduate Student, Southern Mathematics Institute of VSC RAS and the Government of the Republic of North Ossetia-Alania, Marcus St., 22, Vladikavkaz, 362027, Russia, e-mail: tsutsaev@yandex.ru

Quadrature formulas for singular integrals with the Cauchy kernel, similar in accuracy to the Gaussian ones, were constructed. The algebraic degree of accuracy is 2n. But it is characterized by the fact that in the process of n increase in the transition from the present $n=n_1$ to the next $n=n_1+1$ it is necessary to re-calculate the value of function $\phi(t)$, however, not in all nodes of the quadrature but only in part of them. In addition, if the usual quadrature formulas for singular integrals have the highest degree of accuracy, it is only when the singularity parameter was the root of the associated Legendre function of the second kind, the wider range of singularity parameter values exists for the constructed quadrature formulas. These sets are the roots of the Chebyshev polynomials of the first and second kinds.

Keywords: *singular integral with Cauchy kernel, quadrature formula, Chebyshev weight, Gauss accuracy*.

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IMPROVING THE ASSESSMENT OF THE MAXIMUM RATE OF THE NEKRASOV INVERSE BLOCK MATRICES

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Cvetkovich Ljiljana − PhD, Professor, Department of Mathematics and Informatics, Faculty of Science, University of Novi Sad, Serbia, e-mail: lila@dmi.uns.ac.rs

Doroslovački Ksenija − PhD, Faculty of Technical Science, University of Novi Sad, Serbia, e-mail:

ksena4787@yahoo.com
Krukier Boris L'vovich − Candidate of Physical and Mathematical Science, Associate Professor, Department of High Performance Computing and Information and Communication Technologies, Institute of Mathematics, Mechanics and Computer Sciences of the Southern Federal University, Milchakov St., 8a, Rostov-on-Don, 344090, Russia, e-mail: bk@sfedu.ru

Krukier Lev Abramovich − Doctor of Physical and Mathematical Science, Professor, Department of High Performance Computing and Information and Communication Technologies, Institute of Mathematics, Mechanics and Computer Sciences of the Southern Federal University, Milchakov St., 8a, Rostov-on-Don, 344090, Russia, e-mail: krukier@sfedu.ru

The maximum norm bounds of the inverse of a given matrix from some subclasses of block X-matrices were obtained. For block Nekrasov matrices, of the first and second type we will improve obtained bounds, by using a corresponding point-wise bound, published in L. Kolotilina.

Keywords: *X-matrices, block matrices, Nekrasov matrices, maximum norm, inverse matrix.*

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