

**XXXIII International Enlarged Sessions of the Seminar
of Ilia Vekua Institute of Applied Mathematics (VIAM)
of Ivane Javakhisvili Tbilisi State University (TSU)
April 23–25, 2019**



Book of Abstracts

Tbilisi

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The peer-reviewed manuscripts will be published in Reports of Enlarged Sessions of the Seminar of I. Vekua Institute of Applied Mathematics (Journal is indexed in Mathematical Reviews/MathSciNet \odot Zentralblatt MATH/Mathematics Abstracts). The source tex and the corresponding pdf files of the English version of the talk, prepared using the template (information how to prepare an article, together with a LaTeX template is available for download from http://www.viam.science.tsu.ge/en_ses.htm) and not exceeding four A4-format pages should be uploaded in the system

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before May 31, 2019.

Opening of the Seminar will start on April 24, 2019 at 14:00 at I. Vekua Institute of Applied Mathematics (University str. 2, 0186 Tbilisi, Georgia).

As usual on April 23 at 16:00 a visit to Mtatsminda Pantheon is planned, where Ilia Vekua is buried.

ON THE BOUNDARY VALUE PROBLEM OF GENERALIZED ANALYTIC VECTORS

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The Riemann-Hilbert type boundary value problem for some classes of generalized analytic vectors is presented.

ON THE NILPOTENT AND SOLVABLE MR-GROUPS

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We expose fundamentals of the theory of nilpotent MR-groups and compare various definitions of nilpotency in this category.

COMPUTER APPLICATION OF GEORGIAN LANGUAGE

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In the presented article described special approaches and their computer realizations (programs) by using of Georgian language for resolution of following problems: 1. Georgian texts conversion to voice; 2. A full morphological analysis of Georgian words; 3. Composition of the Georgian word by giving a stem and its morphological categories; 4. Division of a Georgian word to morphemes.

ON STATIC ONE-DIMENSIONAL MODELS OF THERMOELASTIC PIEZOELECTRIC BARS

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In the present paper, we consider linear static three-dimensional model [1, 2] with regard to magnetic field of thermoelastic piezoelectric bar consisting of inhomogeneous anisotropic material with variable rectangular cross-section, which may vanish on the butt ends. Applying variational formulation of the boundary value problem corresponding to static three-dimensional model of the bar, when mechanical displacement, electric and magnetic potentials, and temperature may vanish along the butt ends of the bar, and on the remaining parts of the boundary density of surface force, and components of electric displacement, magnetic induction and heat flux vectors along the outward normal vector of the boundary are given, and using generalization of dimensional reduction method suggested by I. Vekua [3] in the classical

theory of elasticity for prismatic shells with variable thickness we construct a hierarchy of static one-dimensional models. We investigate existence and uniqueness of solutions of the obtained one-dimensional boundary value problems in suitable weighted Sobolev spaces. Moreover, we prove that the sequence of vector-functions of three variables restored from the solutions of the one-dimensional problems converges in the corresponding function space to the exact solution of the three-dimensional boundary value problem and under additional conditions we obtain estimate of the rate of convergence.

Acknowledgment. This work was supported by Shota Rustaveli National Science Foundation (SRNSF) [217596, Construction and investigation of hierarchical models for thermoelastic piezoelectric structures].

References

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ON ELASTIC CHARACTERISTICS OF THE SOLID BODY

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Investigating the linear mathematical model of equilibrium of the plane non-homogeneous elastic body by means of complex analysis methods, the immediate functional dependence between Poisson's ratio and Young's modulus was detected in one special case of non-homogeneity.

ON THE LIMIT DISTRIBUTION OF INTEGRAL SQUARE DEVIATION OF WALVERTON-VAGNER TYPE ESTIMATE

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The limit distribution of integral square deviation of Walverton-Vagner type estimate is found and its properties are studied.

ON SOME GOODNESS-OF-FIT TESTS ON WALVERTON-VAGNER TYPE ESTIMATE

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Some goodness-of-fit tests based on Walverton-Vagner type estimate is constructed. The limiting power of the constructed test is investigated. The constructed test is compared with other well-known tests for some type of close alternatives.

UNIFORM CONVERGENCE OF DOUBLE VILENKIN-FOURIER SERIES

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In this paper we study the uniform convergence problem for the rectangular partial sums of double Fourier series on the bounded Vilenkin group of functions from partial bounded oscillation.

SET-THEORETICAL CHARACTERIZATION OF SOME CLASSES OF MEASURES

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In the presented talk we consider various families of the measures and their characterizations in the sense of the set theory. In particular, we investigate the cardinality of some classes of measures.

THE ASYMPTOTIC BEHAVIOR OF EXTREMAL LOWER ESTIMATE OF RECONSTRUCTION OF A LINEAR ORDER ON A FINITE SET

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In the report, we consider reconstructions of a linear order on a finite set and give an extremal lower estimate of those reconstructions. The asymptotic behavior of such estimate is studied.

HYBRID APPROACH FOR LOW-DIAMETER GRAPHS

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In this research papers we will give an overview about Graph algorithms which have emerged as a solution for the analysis of the Modern applications, which generate a massive amount of data. The breadth-first search (BFS) is one of the main graph search algorithms used for graph analysis as it is an important kernel used by many graph-processing applications. In many of these emerging applications of BFS, such as analyzing social networks, the input graphs are low-diameter and scale-free. We will propose a hybrid approach that is advantageous for low-diameter graphs, which combines a conventional top down algorithm along with a novel bottom-up algorithm.

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SOLVING SOME PROBLEMS BY THE DEPTH-FIRST SEARCH ALGORITHM

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In this research paper we will focus on The depth-first search algorithm which helps when there are different vertices that can be visited, while executing a graph search, The problem of this algorithm that it has to go deeply in searching a graph, it has to reach the bottom, when it explores much in a path then the time and space it will take will be very long.

Our aim is to explain more about the depth-first search algorithm and use the idea of the algorithm to implement a project with its codes.

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BOUNDARY VALUE PROBLEMS FOR AN INFINITE STRIP WITH VOIDS

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In the present paper we consider the elastic infinite strip with voids. General representations of a regular solution of a system of equations for a homogeneous isotropic medium with voids [1] are constructed by means of the elementary (harmonic, bi-harmonic and meta-harmonic) functions. Using the Fourier method, the basic BVPs are solved effectively (in quadratures) for an infinite strip.

References

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PROBLEM OF STATICS OF THE LINEAR THERMOEFFECTISITY OF THE MICROSTRETCH MATERIALS WITH MICROSTRUCTURE AND MICROTEMPERATURES

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The representation formula of a general solution of the homogeneous system of differential equations [1] of the linear thermoelasticity of the microstretch materials with microstructure and microtemperatures, obtained in the paper, is expressed by means of three harmonic and four metaharmonic functions. These formulas are very convenient and useful in many particular problems for domains with concrete geometry.

References

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SUPERDIFFUSIVE TRANSPORT IN ASTROPHYSICAL PLASMAS WITH SHEAR FLOWS

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Analytical and numerical simulations' data show that the transport of energetic particles in the presence of magnetic turbulence can be superdiffusive. The so-called anomalous transport has gained growing attention during the last two decades in many fields including laboratory plasma physics, and recently in astrophysics and space physics. Here the examples, both from laboratory and from astrophysical plasmas are shown, where superdiffusive transport has been identified, with a focus on what could be the main influence of superdiffusion on fundamental processes like diffusive shock acceleration and heliospheric

energetic particle propagation. The use of fractional derivatives in the diffusion equation is also discussed, and directions of future investigations are indicated.

Acknowledgment. This work was supported by Shota Rustaveli National Science Foundation project No FR17_279.

NECESSARY AND SUFFICIENT CONDITION FOR THE UNIFORM INTEGRABILITY OF STOCHASTIC EXPONENTIAL

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For the given continuous local martingale M , the associated stochastic exponential $E(M)$ is a local martingale, but not necessarily true martingale. Knowing $E(M)$ is true martingale or not is important for many applications, e.g., Girsanov's theorem is applied to perform a change of measure. We establish a necessary and sufficient condition for the uniform integrability of the stochastic exponential $E(M)$.

Theorem. For the uniform integrability of the stochastic exponential $E(M)$, it is necessary and sufficient, that there exists the predictable process α_s and a non-decreasing function with $f: [0; \infty) \rightarrow (0; \infty)$, such that $\lim_{x \rightarrow \infty} f(x) = \infty$ and:

$$\sup_{\tau \leq T} E \exp \left\{ \int_0^\tau \alpha_s dM_s + \int_0^\tau \left(\frac{1}{2} - \alpha_s \right) d\langle M \rangle_s + f \left(\int_0^\tau \alpha_s^2 1_{\{|1-\alpha_s| < 1\}} d\langle M \rangle_s \right) \right\} < \infty,$$

where sup is taken over all stopping times $\tau \leq T$.

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ABOUT THE EXACT SOLUTION OF THE ROTATING THREE-AXIS GAS ELLIPSOID WHICH IS IN OWN GRAVITATIONAL FIELD

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For the solution of many relevant astrophysical problems connected with the explosive phenomena in gravitating gas bodies of various configuration (a sphere, Maclaurin's spheroid, a three-axis ellipsoid of Jacobi, etc.) and propagation of shock or detonation waves (a surface of a rupture of the first kind of solutions) knowledge of the exact solution before a surface of a rupture of solutions is necessary [1 - 6].

In this work the problem about solid-state rotation with a constant angular speed of the three-axis homogeneous gas ellipsoid which is in its own gravitational field and adjoining on emptiness is considered.

It is known that in the theory of ellipsoidal figures of balance, a half shaft of a steady three-axis ellipsoid of rotation of Jacobi and also the angular speed of rotation, have to satisfy some additional ratios [7].

The equations of the movement of gravitating gas in partial derivatives (the vector equation of gas flow, the scalar equations of continuity and entropy) are considered both in Euler (Cartesian) and in convenient for solutions of this type of problems, spherical coordinates.

The exact solution of a problem on stationary solid-state rotation with a constant angular speed of a homogeneous three-axis gas ellipsoid (the law and speed of the movement of the medium and also thermodynamic characteristics of the medium) which is in its own gravitational field and adjoining on emptiness is found (zero pressure on boundary). The exact distribution of gravitational potential in a three-axis homogeneous ellipsoid satisfying to Poisson's equation is also found.

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MATHEMATICAL MODELS OF RESOLUTION OF CONFLICT BY MEANS OF ECONOMIC COOPERATION AT BILATERAL OR UNILATERAL COUNTERACTION OF GOVERNMENT INSTITUTIONS

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Earlier was offered an original approach for creating of new nonlinear mathematical models of economic cooperation between two politically (not military opposition) mutually warring sides (perhaps the countries or the country and its legal subject) which considers economic or other type cooperation between parts of the population of the sides, directed to rapprochement of the sides and peaceful resolution of the conflict [1 - 4].

In this work new mathematical models are offered where it is meant: in the first case – the governments of both sides, influencing various levers of pressure upon the citizens inclined to mutual economic cooperation, interfere with the process of economic cooperation, and in the second case – the government of one side interferes, and the government of the second and external the sides promote cooperation.

In both cases the dynamic systems describing dynamics of parts of the population of the sides focused on cooperation are obtained. In case of constancy of coefficients of mathematical models special points of nonlinear systems of the differential equations are found. The question of stability of solutions is studied. In both models, at some dependence between constant coefficients of model, the first integrals and analytical solutions are found. The obtained exact solutions allow within these mathematical models and dependences between its coefficients, to define conditions at which economic cooperation will be able to peacefully resolve a political conflict.

In both cases through parameters of management it is possible to define conditions under which perhaps or resolution of conflicts, i.e. definition of the minimum economic investment or power influences with external (minimization of external financial expenses) or inside for permission or continuation of the conflict is impossible.

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ON THE VARIATION FORMULATION OF BVPS FOR PIEZOELECTRIC TRANSVERSELY ISOTROPIC CUSPED BARS

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In (0,0) approximation of hierarchical models of piezoelectric transversely isotropic cusped bars static and oscillation problems are studied by means of variation formulation.

Acknowledgment. This work was supported by Shota Rustaveli National Science Foundation (Grant No 217596, Construction and investigation of hierarchical models for thermoelastic piezoelectric structures).

IDENTIFICATION OF THE BETTER WRF's PARAMETERIZATIONS SET FOR SHOWERS PREDICTION

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Global atmospheric models based on numerical integration of the full system of hydro-thermodynamics and describing the weather processes fair predicted the general character of the weather but can't catch the smaller scale processes, especially for the territories with compound topography. Really, small-scale processes such as convection cannot be explicitly represented in models with grid size more than 10 km. A much finer grid is required to properly simulate frontal structures and represent cumulus convection.

In this article two particulate cases of unexpected heavy showers were studied. Numerical simulations were performed by three sets of domains with horizontal grid-point resolutions of 19.8 km, 6.6 km and 2.2 km. The ability of the WRF model in prediction precipitations with different microphysics and convective scheme components taking into consideration complex terrain of the Caucasus territory was tested. Some results of the numerical calculations performed by WRFC model are presented.

Acknowledgment. This work was supported by Shota Rustaveli National Scientific Foundation Grant N FR17_548.

DYNAMIC LUKASIEWICZ LOGIC AND DYNAMIC MV-ALGEBRAS

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Following K. Segerberg and V. Pratt, who have been introduced dynamic propositional logic [2] and dynamic algebras [1], dynamic propositional Lukasiewicz logic DPL and dynamic MV-algebras are introduced and theories of the logic DPL and dynamic MV-algebras are developed. Dynamic MV-algebras are algebraic counterparts of the logic DPL, that in turn represent two-sorted algebras that combine the varieties of MV-algebras and regular algebras into a single finitely axiomatized variety (M, R, \diamond) resembling R-module with "scalar" multiplication \diamond . Kripke semantics is developed for dynamic propositional Lukasiewicz logic.

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OPTION PRICING FOR GENERAL PAY OFF FUNCTION

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The formula for a fair price of European and American options on the binomial market with several assets was obtained.

VARIADIC EQUATIONAL MATCHING

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In this talk we propose matching in equational theories that specify counterparts of associativity and commutativity for variadic function symbols. We design a procedure to solve a system of matching equations and prove its soundness and completeness. The complete set of incomparable matchers for such a system can be infinite. From the practical side, we identify two finitary cases and impose restrictions on the procedure to get an incomplete terminating algorithm, which, in our opinion, describes the semantics for associative commutative matching built in the symbolic computation system Mathematica

Acknowledgment. This research was supported by Shota Rustaveli National Science Foundation of Georgia (SRNSFG) YS-18-1480.

OPTIMIZATION OF ONE MARKETING RELATIONS MODEL WITH DELAY

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The nonlinear dynamical model for one class of marketing relations with delay in control is given. In the linear case all controls are found which are doubtful on optimality. An example is considered.

INITIAL-VALUE PROBLEM FOR ORDINARY DISTRIBUTED-ORDER DIFFERENTIAL EQUATION

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Consider the equation

$$\int_0^1 \mu(\alpha) D_{0x}^\alpha u(x) d\alpha + \lambda u(x) = f(x), \quad x \in]0, l[, \quad (1)$$

where

$$D_{0x}^\alpha u(x) = \frac{1}{\Gamma(1-\alpha)} \frac{d}{dx} \int_0^x \frac{u(t) dt}{(x-t)^\alpha}, \quad 0 < \alpha < 1$$

is the Riemann-Liouville differentiation operator of fractional order α [1], $\Gamma(\alpha)$ is Euler's gamma function, $\mu(\alpha)$, $f(x)$ are the specified functions, λ is the const.

The differential operator of the form

$$\int_\alpha^\beta b_\xi(x) D_{ax}^\xi y(x) d\xi$$

was first introduced in [1], and its properties were studied in [2].

In this paper, a fundamental solution of equation (1) is constructed and its properties are studied. The solution of the initial-value problem for equation (1) is found in an explicit form. A theorem of uniqueness and existence of the solution to the problem under study is proved.

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GENERATING FUNCTIONS AND SPECTRAL ASYMPTOTICS OF SELF-SIMILAR FRACTAL STRINGS

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Some aspects of the theory of fractal strings will be investigated, emphasising on the case of self-similar strings (corresponding to self-similar subsets of the real line).

There exists a remarkable dichotomy between lattice and nonlattice self-similar fractal strings. In the nonlattice case, where at least one of the logarithmic ratios of the scaling factors is irrational, the fractal string is Minkowski measurable and the asymptotic expansion of its spectral counting function admits a monotonic second term. In the lattice case, where the scaling factors are powers of a common base, the fractal string is not Minkowski measurable and in general its spectrum will show oscillations.

Some of the essential features of a fractal string and, in particular, the intrinsic oscillations in its geometry and spectrum are captured by its geometric zeta function. As announced in a previous paper [1], we show how to obtain the asymptotic behaviour of the spectral counting function of self-similar fractal strings using a generating functions approach applied to their associated zeta functions.

References

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POPULATION GROWTH LOGISTIC MODEL USING POSSIBILITIES FOR FORECASTING POPULATION SIZE OF GEORGIA

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It's well known that population growth bounded by resource limitations can be described by logistic or Verhulst's model,

$$\frac{dP}{dt} = rP \left(1 - \frac{P}{K} \right), \quad (1)$$

where $P(t)$ denotes population size for the moment t , K is the so-called carrying capacity (i.e., the maximum sustainable population) and r is the Malthusian parameter (rate of maximum population growth).

It's easy to see, that the logistic equation (1) has the solution of the form

$$P(t) = \frac{KP_0}{(K - P_0)e^{-rt} + P_0},$$

where P_0 denotes the initial population size.

In this work, population growth logistic model using possibilities for forecasting population size of Georgia, on the basis of 1994-2016 years data, are considered. In particular, it's shown, that in our case this model gives extremely pessimistic forecast estimates. Our forecast estimates accuracies for 2017 and 2018 years (i.e. 2 years ago forecasts), on the basis of this model are analyzed.

LINEAR STABILITY OF THE STEADY STATE SOLUTION AND NUMERICAL APPROXIMATION OF A NONLINEAR PARTIAL DIFFERENTIAL SYSTEM

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The report deals with the linear stability of the steady state solution and numerical approximation of one nonlinear partial differential system. The algorithm of the approximate solution and the results of numerical experiments are given.

ON NUMERICAL MODELING OF SMOG

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The full cycle of fog- and cloud formation in the mesoscale boundary layer of the atmosphere (MBLA) is simulated by numerical methods. Aerosol diffusion in MBLA from a point source is also simulated. It is possible to simulate smog formation by 'superposition' models of humidity processes and aerosol diffusion in MBLA.

ON THE RIEMANN-HILBERT PROBLEM WITH SHIFT

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We consider so called Beltrami parametrization of Riemann surfaces and show that the Riemann-Hilbert boundary value problem with a shift is equivalent of the classical Riemann-Hilbert boundary value problem respect to complex structures defined from Beltrami parametrization induced from the shift operator.

THE IMPACT OF BOJARSKI'S WORKS ON THE THEORY OF ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS ON THE PLANE

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In memory of Bogdan Bojarski

The period of the formation of the theory of generalized analytic functions, nowadays known as the Bers-Vekua theory, meets the beginning of scientific activity of Bogdan Bojarski together with his supervisor Ilia Vekua in Moscow. Bojarski's fundamental new approach to the solution of the system of elliptic partial differential equations on a plane, opened up a direct pathway to many important issues in the

geometric theory of analytic functions and related boundary value problems. We give a short overview of important results of Bogdan Bojarski in the theory of generalized analytic functions and his point of view on the theory of boundary value problems.

ON THE CONVERGENCE OF GENERAL FOURIER SERIES OF DIFFERENTIABLE FUNCTIONS

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S. Banach proved that good differential properties of a function do not guarantee the a. e. convergence of the Fourier series of this function with respect to general orthonormal systems (ONS). In the present paper conditions on the functions of an ONS under which the Fourier series of differentiable functions are convergent a.e. are found.

LOCALIZED BOUNDARY-DOMAIN INTEGRAL EQUATIONS APPROACH WITH PIECE WISE CONSTANT CUT-OFF FUNCTION FOR THE DIRICHLET PROBLEM OF THE HEAT TRANSFER EQUATION WITH A VARIABLE COEFFICIENT

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Localized boundary-domain integro-differential equations (LBDIDE) system associated with the Dirichlet boundary value problem (BVP) for the stationary heat transfer partial differential equation (PDE) with a variable coefficient is obtained and analyzed. The parametrix is localized by a characteristic function of a ball of radius ε which is not a smooth cut-off function in the whole space. The main result of the present paper is the equivalence theorem of the LBDIDE system to the original variable-coefficient BVP and unique solvability of the LBDIDE system in the corresponding Sobolev spaces.

ON THE TYPE OF SPLITTING OF VECTOR FIBRATION ON THE RIEMANN SPHERE INDUCED BY THE HYPERGEOMETRIC EQUATION

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The present work deals with the hypergeometric equation and the type of splitting of vector fibration induced by this equation is established.

ON BASIC BOUNDARY VALUE PROBLEMS FOR THE INFINITE PLANE WITH A CIRCULAR HOLE WITH VOIDS

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The basic boundary value problems for the infinite plane with a circular hole with voids are solved.

ON NUMERICAL REALIZATION OF THE PERTURBATION ALGORITHM FOR THE INITIAL-BOUNDARY VALUE PROBLEM FOR PARABOLIC EQUATION

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The perturbation algorithm for the initial-boundary value problem for spatial one and two dimensional variable parabolic equation is considered. We have obtained the numerical realization of the algorithm, analysis of the numerical results and graphics images.

USING MULTI-CRITERIA PARTITIONING AND COVERING PROBLEMS FOR SOLVING SOME LOCATION PROBLEMS

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A new approach for solving a multi-criteria location is proposed, within which these problems are reduced to the problems of multi-criteria partitioning and covering, after which it becomes possible to find Pareto-optimal solutions using exact or approximate algorithms.

INTEGRATIVE ANALYSIS OF MULTI-OMICS DATA

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Biological regulation of cells identity and function runs at several levels of genetic and epigenetic processes including gene expression, chromatin openness, DNA methylation, histone modifications, etc. To obtain an understanding of the function of each molecular level in connection to other levels, researchers are interested in integration and combined analysis of such data sets, generally known as multi-omics. Especially, recent technology developments facilitate collection of multi-omics data at single cell level, hence provide the opportunity to acquire a more holistic representation of cell heterogeneities by information coding and regulation of several molecular levels in single cells. New computational methods are thus emerging to address integration and joint analysis of multiple data modalities. Here I present a brief summary of my research interests in analysis of such multi-omics data.

LOCAL VARIATION FORMULAS OF SOLUTION FOR THE NONLINEAR DIFFERENTIAL EQUATIONS WITH DELAY IN THE PHASE COORDINATES AND CONTROLS

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The local variation formulas of solution are obtained, in which the effects of the discontinuous initial condition and perturbations of delays are revealed.

ON BVPs FOR PIEZOELECTRIC TRANSVERSELY ISOTROPIC CUSPED BARS

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In $(0,0)$ approximation of hierarchical models of piezoelectric transversely isotropic cusped bars we consider static and oscillation problems. We analyze peculiarities of nonclassical setting boundary conditions.

Acknowledgment. This work was supported by Shota Rustaveli National Science Foundation (Grant No 217596, Construction and investigation of hierarchical models for thermoelastic piezoelectric structures).

ON A NONLINEAR INTEGRO-DIFFERENTIAL EQUATION OF PARABOLIC TYPE

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The report deals with the investigation and numerical solution of the nonlinear integro-differential equation of parabolic type. Asymptotic behavior of solution of the initial-boundary value problem and convergence of the finite-difference scheme is studied.

APPROXIMATE SOLUTION OF SOME BOUNDARY VALUE PROBLEMS OF TENSION-COMPRESSION AND BENDING OF PLATES

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In the paper using the method of fundamental solutions approximate solutions of some boundary value problems for the tension-compression and bending of plates of constant thickness with holes are constructed. The elastic equilibrium of the plates is described by a system of equations of I. Vekua in the case of approximation $N = 1$.

THE EULER INTEGRAL OF THE FIRST KIND. HIGHER ORDER SINGULARITIES

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In the talk it is shown, that the Euler integral of the first kind in some area of its divergence is integrable in the sense of generalized functions. In addition, it is shown the identity of the mentioned integral with the Fourier transform of the singular exponential function. It is found a functional form and an analytic

representation of the singular beta-integral. On the basis of this latter, a formula of the Sokhotski-Plemelj' type is derived.

**SPECIAL CASE OF THE LINEAR CONJUGATION NONHOMOGENEOUS BOUNDARY
VALUE PROBLEM FOR CARLEMAN-VEKUA
IRREGULAR EQUATION.**

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The special case of the linear conjugation nonhomogeneous boundary value problem for Carleman-Vekua irregular equation when the boundary function has zeros and poles at some points of the boundary curve is considered. The coefficients of this equation belong to sufficiently wide classes of functions which are the generalizations of Vekua classical space. The formula of the general solution and the necessary and sufficient solvability conditions of this problem are established.

**AN EXAMPLE OF APPLICATION OF CBM TO
INTERSECTION-UNION HYPOTHESES TESTING**

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Application of CBM to the testing of the intersection of a sub-set of basic hypotheses against an alternative one is considered. Optimal decision rule allows us to restrict the Type-I and Type-II errors rates on the desired levels.

**A NOTE ON OSCILLATION OF SOLUTIONS OF N-TH ORDER NONLINEAR
DIFFERENCE EQUATIONS**

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Consider the difference equation

$$\Delta^{(n)}u(k) + p(k)|u(\sigma(k))|^\lambda \text{sign}(u(\sigma(k))) = 0$$

where $\Delta^{(1)}u(k) = u(k+1) - u(k)$, $\Delta^{(i)}u(k) = \Delta \circ \Delta^{(i-1)}u(k)$, $(i = 2, \dots, n)$. $p : N \rightarrow N$, $\sigma : N \rightarrow N$, $\lim_{k \rightarrow +\infty} \sigma(k) = +\infty$. Sufficient conditions of solutions of the above equation are obtained when $\lambda > 1$ or $0 < \lambda < 1$.

ON THE PARAMETERS PROBLEM FOR THE SCHWARZ-CHRISTOFFEL MAPPING

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One of the possible ways to solve the parameters problem for the Schwarz-Christoffel mapping in case of four points will be considered. The algorithm of calculation of the parameters will be given.

A PROBLEM OF DETERMINING EQUAL STRENGTH CONTOUR IN THE CASE OF AXISYMMETRIC STRETCHING

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The problem of determining the shape of a uniform-strength contour in the case of axial stretching of a rectangular plate with partial unknown boundary is considered. The analysis of the results obtained for different values of external forces is given.

A REPRESENTATION FORMULA OF A GENERAL SOLUTION OF THE HOMOGENEOUS SYSTEM OF DIFFERENTIAL EQUATIONS FOR THE MICROSTRETCH MATERIALS WITH MICROSTRUCTURE AND MICROTEMPERATURES

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We consider the stationary oscillations of the Microstretch materials with microstructure and microtemperatures [1]. The representation formula of a general solution of the homogeneous system of differential equations, obtained in the paper, is expressed by means of seven metaharmonic functions. These formulas are very convenient in many particular problems for domains with concrete geometry.

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ON EXTENSIONS OF CERTAIN POINT-SETS

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Let X is any point-set in Euclidean space R^n .

We say that a line segment l is admissible for X if its end-points are singletons in X and there exists an edge of X containing l .

Theorem. Let X be a finite quasi-Diophantine subset in the R^n . Then the length of each admissible line segment for X is a rational number.

ON THE QUANTUM PROPERTIES OF 3D CARBON NANOSTRUCTURES

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The mathematical model connected with the quantum properties of carbon nanostructures is discussed from the non-relativistic viewpoint. The Schrödinger equation with the homogeneous boundary conditions is studied in the prism with the hexagonal cross-section. The analytic solutions are obtained and the energies of electrons are estimated.

FISCHER-KOLMOGOROV'S BOUNDARY TASK IN THE MODEL OF INFORMATIVE CONFRONTATION

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The paper describes an attempt to study information confrontation by means of a mathematical model that describes the non-linear partial differential equation. In particular, the model of information opposition which comes down to a boundary task of Fischer-Kolmogorov-Petrovsky-Piskunov [1,2] is offered.

Acknowledgment. This work was supported by the support of Shota Rustaveli National Science Foundation Grant YS17_78.

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AUTOMORPHISM GROUPS OF PARTIAL MONO-UNARY ALGEBRAS AND CH

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A characterization of all cardinal numbers that are cardinals of automorphism groups of partial mono-unary algebras is given. Some connections are also established between the notion of an automorphism of partial mono-unary algebras and the continuum hypothesis. Close connections of the obtained results with one problem of S. Ulam are also considered. The main result is the following

Theorem. For any infinite set A , the following two propositions are equivalent:

1. \mathfrak{A} is the cardinality of the automorphisms group of some partial mono-unary algebra whose universe is A ;

2. $1 \leq \mathfrak{A} \leq \aleph_0$ or $\mathfrak{A} = 2^\mu$ for some cardinal number $\mu \leq |A|$.

BAYESIAN CONSISTENT CRITERIA FOR STATIONARY SEQUENCES WITH CONTINUOUS TIME

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Existence of Bayesian [1] consistent criteria for stationary sequences with continuous time is investigated.

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ALMOST LINEAR DIFFERENTIAL EQUATIONS WITH SEVERAL DEVIATING ARGUMENTS

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Almost linear differential equations with several deviating arguments

$$u^{(n)}(t) + \sum_{i=1}^m p_i(t) |u(\sigma_i(t))|^{\mu_i(t)} \operatorname{sign} u(\sigma_i(t)) = 0$$

are considered, where $p_i \in L_{\text{loc}}(R_+; R)$, $\sigma_i \in C(R_+; R_+)$, $\lim_{t \rightarrow +\infty} \sigma_i(t) = +\infty$, $\mu_i \in C(R_+; (0, +\infty))$, $\lim_{t \rightarrow +\infty} \mu_i(t) = 1$ ($i = 1, \dots, m$). The sufficient conditions are obtained for solutions to be oscillatory.

BITSADZE–SAMARSKII TYPE PROBLEM FOR A LOADED MIXED EQUATION WITH DEGENERATION OF ORDER IN THE DOMAIN OF HYPERBOLICITY

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A characteristically loaded [1] mixed hyperbolic-parabolic equation with degeneration of order in the domain of its hyperbolicity

$$\begin{cases} u_{xx} - u_y + \lambda_1 u(x, 0) = f_1(x, y), & y > 0, \\ u_x + u_y + cu + \lambda_2 u(x - y, 0) = f_2(x, y), & y < 0, \end{cases} \quad (1)$$

is investigated in the domain Ω , bounded by the straight line segments $x = 0$, $x = r$, $y = T > 0$ as $y > 0$ and $x - y = 0$, $x - y = r$ of equation (1) as $y < 0$; $u = u(x, y)$, λ_1, λ_2, c are the given constants, $f_1(x, y), f_2(x, y)$ are the given functions.

For equation (1), we research the following non-local inner boundary value

Problem BS. Find a solution to equation (1) $u \in C(\bar{\Omega}) \cap C^1(\Omega) \cap C_x^2(\Omega \cap \{y > 0\})$ in the domain Ω satisfying the boundary conditions:

$$\begin{aligned} u(0, y) &= \varphi_0(y), \quad 0 \leq y \leq T, \\ u(x_0, y) &= \alpha(y)u(r, y) + \beta(y), \quad 0 < x_0 < r, \quad 0 \leq y \leq T, \end{aligned}$$

where $\varphi_0(y), \alpha(y), \beta(y)$ are the given functions, $\alpha(y) \neq 0$.

If $x_0 = 0$ as $\alpha(y) \neq 0$ or $x_0 = r$ as $\alpha(y) \neq 1$ the problem BS turns into a local boundary value problem, which for a non-characteristically loaded equation with degeneration of order in the domain of its hyperbolicity is investigated in [2]. But if the conditions regarding $\alpha(y)$ are not met the problem becomes incorrect. The inner-boundary value problem of Bitsadze-Samarsky type for a model mixed hyperbolic-parabolic equation of the second order is studied in [3], and for a second-order hyperbolic-parabolic equation with a non-characteristic loading on lines of the type-changing is studied in [4].

In this paper, we prove existence and uniqueness theorem for the solution to the problem BS.

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ON SUB-GAUSSIAN RANDOM ELEMENTS IN A BANACH SPACE

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We discuss a characterization of weakly Sub-Gaussian random elements which are T -Sub-Gaussian in infinite-dimensional Banach and Hilbert spaces. The talk is based on [1].

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LIMITING DISTRIBUTION OF A SEQUENCE OF FUNCTIONS DEFINED ON A MARKOV CHAIN

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It is shown that the limiting distribution of partial sums of a functional sequence defined on a Markov Chain is established for the case when the chain is ergodic, with one class of ergodicity and contains cyclical subclasses.

ON THE ASYMPTOTIC BEHAVIOR OF SOLUTIONS OF NONLINEAR FUNCTIONAL DIFFERENTIAL EQUATIONS

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An operator differential equation

$$u^{(n)}(t)+F(u)(t)=0$$

is considered, where $F \in V(\tau)$, $\tau \in (R_+; R_+)$, $\lim_{t \rightarrow +\infty} \tau(t) = +\infty$. (By $V(\tau)$ denote the set of continuous mappings $F : C(R_+; R_+) \rightarrow L_{loc}(R_+; R)$ satisfying the condition: $(F(x)(t) = F(y)(t))$ holds for any $t \in R_+$ and $x, y \in C(R_+; R)$ provided that $x(s) = y(s)$ for $s \geq \tau(t)$). Sufficient conditions of new type for oscillation of solutions of the above equation are established.

REPRESENTATION OF A GENERAL SOLUTION OF ELLIPTIC SYSTEMS OF SOME CLASSES

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The present talk deals with the representation of a general solution of elliptic differential systems of some classes on the complex plane by means of analytic functions. Some applications of the obtained results are presented.

NON PERTURBATIVE EXTENSION OF PERTURBATIVE QUANTUM CHROMODYNAMICS

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Introduction in dimensional regularization and renormalization of quantum field theories, exact infrared (ultraviolet) extension of quantum chromo (electro) dynamics are given.

ON THE SYSTEMS OF EQUATIONS WITH THE PARTIAL DERIVATIVES OF FRACTIONAL ORDER

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We consider linear systems of partial differential equations of fractional order not exceeding one of the following form

$$D_{0x}^{\alpha}u(x, y) + AD_{0y}^{\beta}u(x, y) = Bu(x, y) + f(x, y), \quad 0 < \alpha, \beta \leq 1, \quad \alpha \cdot \beta < 1,$$

where $u(x, y) = (u_1(x, y), \dots, u_n(x, y))$ and $f(x, y) = (f_1(x, y), \dots, f_n(x, y))$ are the unknown and given vector functions, respectively, A and B are given constant $n \times n$ matrices, D_{ot}^{ν} is the Riemann – Liouville fractional integro-differentiation operator of order ν [1, p. 9].

In this paper, classes of correct initial and initial-boundary value problems for such systems are described. It is shown that these systems can be divided into two different types, which differ significantly in terms of the formulation of correct boundary value problems. The first type includes systems with positive eigenvalues of matrix coefficients in the main part [2, 3]. To the second type, the systems, the matrix coefficients in the main part of which have eigenvalues of different signs [4, 6].

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STOCHASTIC INTEGRAL REPRESENTATION OF POISSON FUNCTIONALS WITH AN EXPLICIT FORM OF THE INTEGRAND

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In the 80th of the past century, it turned out ([1]) that the martingale representation theorems (along with the Girsanov's measure change theorem) play an important role in the modern financial mathematics. In particular, using the integrand of the stochastic integral appearing in the integral representation, one can construct hedging strategies in the European options of different type. After Clark ([2]) obtained the formula for the stochastic integral representation for Wiener functionals, many authors tried to find the integrand explicitly, and the corresponding results were obtained when the functionals were smooth in some sense. The constructive integral representation is based on the Malliavin (stochastic) derivative and in Wiener case it is known as the Clark-Ocone formula ([3]) and in the case of normal martingales M for functionals from the class $D_{2,1}^M$ -- as the Clark-Haussmann-Ocone formula ([4]). We ([5]) have introduced the space $D_{\alpha,1}^M, 1 < \alpha < 2$ and extended the Clark-Haussmann-Ocone formula for functionals from this space. We proposed ([6], [7]) a new approach to the definition of the stochastic derivative of the operator of Poisson functionals and obtained the explicit form of the integrand in the integral representation. Here a more convenient and practical form for finding the explicit expression of the integrand expression in the Clark-Haussmann-Ocone representation of functionals of the Poisson process N will be found. In particular, in the conditional mathematical expectation of the above-mentioned integrand the σ -algebra $\mathfrak{F}_{t-}^N = \sigma(\bigcup_{s < t} \mathfrak{F}_s^N)$ can be replaced by a more natural σ -algebra $\mathfrak{F}_t^N = \sigma\{N_s, 0 \leq s \leq t\}$, which, in turn, allows us to more effectively use the well-known properties of the Poisson process.

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BANACH SPACE VALUED FUNCTIONALS OF THE WIENER PROCESS

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We develop the problem of representation of Banach space valued functionals of the one-dimensional Wiener process by the Ito stochastic integral. Yearly (see [1]) we developed this problem in case, when the joint distribution of the Wiener process and of functional of the Wiener process is Gaussian. This problem is in some sense opposite to the problem of existence of the stochastic integral: here we have the stochastic integral as a random element and the problem is to find the integrand as a Banach space valued nonanticipative random process. We consider the generalized stochastic integral for a wide class of predictable random processes and we reduce the problem of existence of the integrand process to the problem of decomposability of the generalized random element.

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TWO-WEIGHT INEQUALITIES FOR MULTI(SUB)LINEAR STRONG FRACTIONAL MAXIMAL FUNCTIONS

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New two-weight inequalities for various type of multi(sub)linear strong fractional maximal operators are derived. Among others, we obtained Fefferman-Stein type inequalities and criteria guaranteeing trace inequalities for these operators. Characterization of the boundedness of multi(sub)linear strong fractional maximal operators defined with respect to the doubling measure is also derived.

Acknowledgment. The work was supported by the Shota Rustaveli National Science Foundation Grant, Project No. FR-18-2499.

I. VEKUA'S METHOD FOR THE NONLINEAR THEORY OF NON-SHALLOW SHELLS

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In this paper by means of I. Vekua's method the system of differential equations for the nonlinear theory of non-shallow shells is obtained. Using the method of a small parameter and complex variable functions approximate solutions are constructed for any N approximation.

INVESTIGATION OF MULTI-FIELD PROBLEMS FOR COMPOSED ELASTIC STRUCTURES BY THE INTEGRAL EQUATION METHOD

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We investigate multi-field problems for complex elastic anisotropic structures when in different adjacent components of the composed body different refined models of elasticity theory are considered. In particular, we analyse the case when we have the generalized thermo-electro-magneto elasticity model (GTEME model) in one region of the composed body and the generalized thermo-elasticity model (GTE model) in another adjacent region. Both models are associated with Green-Lindsay's model [1], [2]. This type of mechanical problem is mathematically described by systems of partial differential equations with appropriate transmission and boundary conditions. In the GTEME model part we have six dimensional unknown physical fields (three components of the displacement vector, electric potential function, magnetic potential function, and temperature distribution function), while in the GTE model part we have four dimensional unknown physical fields (three components of the displacement vector and temperature distribution function). The diversity in dimensions of the interacting physical fields complicates mathematical formulation and analysis of the corresponding boundary-transmission problems.

We apply the potential method and the theory of pseudodifferential equations and prove uniqueness and existence theorems of solutions to different type basic and mixed boundary-transmission problems in appropriate Sobolev spaces. We analyse the smoothness and singularity properties of solutions to mixed and interfacial crack type problems.

Acknowledgment. This work was supported by Shota Rustaveli National Science Foundation of Georgia (SRNSF) (Grant number FS-18-126).

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ON THE GENERAL MATHEMATICAL MODEL OF AUTOIMMUNE DISEASES AND ITS TREATMENT

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In this paper we propose the general mathematical model of autoimmune diseases obtained by generalization of mathematical model of rheumatoid arthritis [1]. By offered model can be described progress and treatment of various autoimmune diseases. According the model, there are target cells that are recognized as "foreign" cells by immune system and immune system begins to attack them. In this process B-, Treg- and Th- lymphocytes are involved. The model is a system of non-linear ordinary differential equations. Equations determine change of size of target cell population, B-, Th-, Treg- cell populations and amount of drug in the blood. The model assumes that the disease occurs when the number of B lymphocytes exceeds the limit value. The model involves the drug, that promotes target cells proliferation and/or reduction of B-lymphocytes to the limit value by influence on Th- and Treg- cells. Based on the model, it is possible to set a control problem with respect to the dosage and effectiveness of the drug

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SOME PROPERTIES OF $Q_{1,N}$ -REDUCIBILITY

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Tennenbaum (see [3, p.159]) defined the notion of Q -reducibility on sets of natural numbers as follows: a set A is Q -reducible to a set B (in symbols: $A \leq_Q B$) if there exists a computable function f such that for every $x \in \omega$ (where ω denotes the set of natural numbers), $x \in A \Leftrightarrow W_{f(x)} \subseteq B$. We say in this case that $A \leq_Q B$ via f . If $A \leq_Q B$ via a computable function f such that for all x, y $x \neq y \Rightarrow W_{f(x)} \cap W_{f(y)} = \emptyset$ and $\bigcup_{x \in \omega} W_{f(x)}$ is computable, then we say that A is $Q_{1,N}$ -reducible to B , and denoted $A \leq_{Q_{1,N}} B$. The notion of $Q_{1,N}$ -reducibility was introduced by Bulitko in [1].

Our notations and terminology are standard and can be found in [1], [2] and [4].

Theorem 1. Let $R_1 \supseteq R_2 \supseteq \dots \supseteq R_{2n+1}$ be c.e. sets, $R_1 \neq \omega$ and let $P_k = \bigcup_{1 \leq i \leq \lfloor \frac{k+1}{2} \rfloor} \{A_{2i-1} - A_{2i}\}$,

\overline{P}_k is an infinite and not immune, $k = 1, 2, \dots, 2n+1$, where for all i , $A_i = R_i$, except when k is an odd number, in which case we have $A_i = R_i$, for all k , $1 \leq i \leq k$, but $A_{k+1} = \emptyset$. Then, for all k , $k \geq 1$, $P_{2k} \leq_{Q_{1,N}} P_{2k-1}$, $P_{2k} \leq_{Q_{1,N}} P_{2k+1}$, $P_{2k} \leq_{Q_{1,N}} P_{2k+2}$.

Theorem 2. Let A and B be c.e. sets such that $A - B \neq_Q \emptyset$ and $\overline{A \cap B}$ is infinite and not immune. Then A is a disjoint union of c.e. sets A_0 and A_1 such that $A_i - B \leq_{Q_{1,N}} A - B$ and $A_i - B \not\leq_Q A_{i-1} - B$, $i = 0, 1, \dots$

Theorem 3. For any noncomputable c.e. nonsimple set A there is a noncomputable c.e. set B , $B \subset A$, such that for every noncomputable c.e. set W we have

$$W \not\leq_Q A - B <_{Q_{1,N}} A.$$

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ON A NUMERICAL REALIZATION FOR A TIMOSHENKO TYPE ONE NONLINEAR BEAM EQUATION

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The presented work is a direct continuation of articles [1]-[4], which consider the construction of algorithms and the corresponding numerical computations for the approximate solution of nonlinear integro-differential equations of Kirchhoff and Timoshenko types. In particular consider an initial-boundary value problem for the J. Ball integro-differential equation, which describes the dynamic state of a beam (see, [5]). The solution is approximated by using the Galerkin method, symmetrical stable difference scheme and the Jacobi iteration method. The algorithm has been approved for tests. The results of computations are represented by tables and graphics.

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ON THE ACCURACY OF A DIFFERENCE SCHEME FOR A NONLINEAR DYNAMIC BEAM PROBLEM

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The paper deals with the boundary value problem for a system of nonlinear integro-differential equations modeling the dynamic state of the Timoshenko beam. To approximate the solution with respect to the time variable a difference scheme is used, the error of which is estimated.

THE TRIAL VERSIONS OF THE NEW DEVELOPING TOOLS OF THE GEORGIAN UNIVERSAL SMART CORPUS

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In the present paper, the trial versions of the new developing tools of the Georgian Universal Smart Corpus will be presented. These trial versions were developed within the PHDF-18-1228 project "In the

European Union with Georgian and Abkhazian Languages, i.e. the Doctoral Thesis - Elaboration of the New Developing Tools and Methods of the Georgian Smart Corpus and Improvement of Already Existing Ones" (PhD student Shalva Malidze, scientific supervisor Konstantintine Pkhakadze) and, also, they were developed within the doctoral thesis Methods and Tools for the Automatic Intellectual Classification of Georgian Texts" (PhD student Konstantine Demurchev, Scientific supervisor Konstantintine Pkhakadze). The trial versions are based on the methods and tools already developed within the confines of the Georgian Talking Self-Developing Intellectual Corpus [1] and they are aimed at the defence of Georgian and Abkhazian languages from danger of digital extinction in the rapidly forthcoming digital age [2].

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SCHWARZ PROBLEM FOR FRACTIONAL CAUCHY-RIEMANN SYSTEM

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Consider the equation

$$\left(\frac{\partial}{\partial x} + i \frac{\partial^\alpha}{\partial y^\alpha} \right) w(x, y) = 0$$

where $\frac{\partial^\alpha}{\partial y^\alpha}$ is the fractional derivative of the order α [1]. For $\alpha = 1$ this equation coincides with the Cauchy-Riemann system. In this paper we discuss analogs of the Cauchy and Schwarz formulas, giving solutions to the equation under consideration in the upper half-plane via the boundary values on the real axis.

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APPLICATION OF THE FRACTIONAL OSCILLATOR MODEL TO DESCRIBE DAMPED VIBRATIONS

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We consider a model of damped vibrations based on fractional differentiation. The fractional oscillator equation:

$$\frac{d^{1+\alpha} u}{d\xi^{1+\alpha}} + u = 0,$$

$$\frac{d^{1+\alpha}u(\xi)}{d\xi^{1+\alpha}} = \frac{1}{\Gamma(1-\alpha)} \int_0^\xi \frac{d^2u(s)}{ds^2} \frac{ds}{(\xi-s)^\alpha},$$

where $1 + \alpha$ is the fractional derivative order. The given model is completely consistent with the classical model of vibration with viscous damping. We find the relation between the order of fractional differentiation in the equation of motion and Q-factor of an oscillator:

$$\alpha \approx 1 - \frac{2}{\pi Q}.$$

The proposed approach seems more appropriate for the physical nature of the described system. The experiment with the vibrating piezoelectric plate, performed as part of the study, showed good agreement with the model and confirmed that the fractional oscillator model can be used to describe strongly damped vibrations.

Acknowledgment. The reported study was funded by RFBR (project 18-51-45005).

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ON THE STABILITY OF BIJECTION IN BANACH SPACE IN CASE OF NON-LINEAR PERTURBATION

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Applying schemes for proofs for “symmetric” theorems about the closure and self-adjointness stability for linear operators, from the widely-known book “Perturbation Theory for Linear Operators” by T. Kato, we prove the following: Let A and B be densely defined operators (linearity is not necessary) in Banach space X . Let $D(A)$ is a subset of $D(B)$ and let the following inequalities hold for any vector u and v in $D(A)$: $\|Bu - Bv\| \leq c\|Au - Av\|$ and $\|Bu - Bv\| \leq q\|Au - Av\| + \|(A+B)u - (A+B)v\|$, where c and q are positive constants and $q < 1$. The operator A is bijection if and only if when the operator $(A+B)$ is also a bijection. In this case, the operator A^{-1} is continuous (A is homeomorphism) if and only if when $(A+B)^{-1}$ is continuous ($(A+B)$ is homeomorphism).

MAUDE-NPA AND FORMAL ANALYSIS OF NTRU-BASED PROTOCOLS

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In this talk we present preliminary work that is done under the joint project funded by Shota Rustaveli National Science Foundation of Georgia and TUBITAK. In the first part we discuss several quantum NTRU-based key exchange protocols, which are developed by our colleagues from Turkey.

In the second part we speak about Maude-NPA, which is a tool for formal analysis of cryptographic protocols. We will discuss its possibilities to analyze quantum protocols.

BAYESIAN CONSISTENT CRITERIA FOR STATIONARY SEQUENCES

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Existence of Bayesian [1] consistent criteria for stationary sequences is studied.

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EXPLICIT BOUND OF THE QUADRATIC RISK OF THE GRENANDER ESTIMATOR

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We consider in this report the Grenander estimator of unbounded, in general, nonincreasing densities on the interval $[0,1]$ without any smoothness assumptions. For fixed number n of i.i.d. random variables X_1, X_2, \dots, X_n with values in $[0,1]$ and the nonincreasing density function $f(x)$, $0 < x < 1$, we prove an inequality bounding the quadratic risk of the Grenander estimator by explicit multiplier and the appropriate order of n .

NECESSARY CONDITIONS OF OPTIMALITY FOR THE NONLINEAR OPTIMAL CONTROL PROBLEM WITH SEVERAL DELAYS AND THE CONTINUOUS AND DISCONTINUOUS INITIAL CONDITIONS

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For the optimal control problem with several constant delays in the phase coordinates and controls the necessary conditions of optimality are obtained for the initial and final moments, for delays having in the phase coordinates and the initial vector, for the initial function and control. The effects of the continuous and discontinuous initial conditions are revealed.

ON THE CONVERGENCE OF CESÀRO MEANS OF NEGATIVE ORDER OF VILENKIN-FOURIER SERIES

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In 1971 Onnewer and Waterman established a sufficient condition which guarantees uniform convergence of Vilenkin-Fourier series of the continuous function. In this paper we consider different classes of functions of generalized bounded oscillation and in terms of these classes sufficient conditions for uniform convergence of Cesàro means of negative order are established.

ON THE SPACES OF GENERALIZED THETA-SERIES WITH SOME QUADRATIC FORMS OF FIVE VARIABLES

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In this paper the upper bounds of the dimensions of the spaces of generalized theta-series with some quadratic forms of five variables are obtained. The basis of the spaces of generalized theta-series is constructed.

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THE ALGORITHM TO CONSTRUCT THE EIGENFUNCTIONS OF THE MULTI-VELOCITY TRANSPORT THEORY

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The algorithm to construct the eigenfunctions of the characteristic equation of the multi-velocity transport theory by the Legendre polynomials is presented.

ON ONE PROBLEM OF THE PLANE THEORY OF ELASTIC MIXTURE WITH A PARTIALLY UNKNOWN BOUNDARY

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In the paper we consider the problem of statics of the linear theory of elastic mixture to find a partially unknown boundary for a rectangular domain which is weakened by an equally strong contour (the unknown part of the boundary). The unknown part of the boundary is assumed to be free from external force, and to the remaining part of the rectangular boundary are applied the same absolutely smooth rigid punches subjected to the action of external normal contractive forces with the given principal vectors.

Using the general Kolosov-Muskhelishvili type formulas and the methods of the theory of analytic functions an elastic equilibrium of the plate and analytic form of an unknown contour are defined, under the condition that the tangential normal stress takes on the contour constant value.

POTENTIAL METHOD IN THE LINEAR THEORY OF VISCOELASTICITY OF BINARY MIXTURES WITH POROUS

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The boundary value problems of steady vibrations in the linear theory of viscoelasticity of binary mixtures with porous is considered, where the constituents of mixture are a Kelvin-Voigt material and an isotropic elastic solid. The existence and uniqueness theorems for classical solutions of these problems are proved by means of the potential method.

ON THE REPRESENTATION OF SOLUTION OF THE PERTURBED CONTROLLED DIFFERENTIAL EQUATION WITH DELAY

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For the nonlinear perturbed controlled differential equation with constant delay in the phase coordinates a formula on the representation of solution is obtained. In the formula the effect of perturbation of the delay parameter is detected.

“ d_i - KNIFE” AND THE PROCESS OF CUTTING OF GRT_m^n BODIES

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In this report, we consider GRT_m^n (Generalized Rotated and Twisted bodies which were analytically described in 2006 by Paolo Emilio Ricci and Ilia Tavkhelidze in [1]) and the cutting of these bodies using a “ d_i -knife” (as defined by Johan Gielis and Ilia Tavkhelidze [2] with $i = 1, 2, \dots, m$, divisors of the number

m). We will show how many independent objects appear after one complete cut with such knives along the basic line of the described bodies. The number of independent bodies depends on m and on its divisors, but never depends on the number of torsion n , unlike the case with GML_m^n – Generalized Möbius-Listing’s bodies.

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ON A NEW PROOF OF THE EXISTENCE OF rt -SETS OF CARDINALITY $(d+1)$ IN R^d SPACE

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A.B. Kharazishvili proved the existence of rt -sets of cardinality $(d+1)$ in R^d space, for every natural $d \geq 3$ (see [1]). Also, a characterization of all rt -sets in R^d space is established in the same work. In our talk a new proof of the above-mentioned theorem is presented. In addition, several theorems related to the so-called at -, rt -, ot - and ρ - at -, ρ - rt -, ρ - ot - sets are considered.

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ON CANTOR’S Λ FUNCTIONALS

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In our talk summable series with respect to the systems $\Phi = (\varphi_n(t))_{n=0}^{\infty}$ of finite and measurable functions defined on $[0,1]$ by positive, regular, triangular Λ matrixes are considered. It is assumed that the empty set is a \mathcal{U} set for these Λ summability methods. It is introduced the notion of Cantor’s functional for Λ summable series. This notion generalizes, in particular, any trigonometric integral (for example, Lebesgue, Denjoy, Marcinkiewicz-Zygmund and other trigonometric integrals) in the sense of the reconstruction of coefficients of the series. Various properties of Cantor’s Λ functional are also established.

Acknowledgment. This work was supported by the grant DI 18-118 of Shota Rustaveli National Science Foundation of Georgia.

THE CHANGE OF VARIABLE FORMULAS FOR DIFFERENTIABLE NON-ANTICIPATIVE FUNCTIONALS

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A pathwise derivative for functionals on the space of continuous paths is introduced. For differentiable non-anticipative functionals the Ito formula for continuous semimartingales is proved.

ON STATISTICAL ESTIMATION OF THE INITIAL PROBABILITY DISTRIBUTION ACCORDING TO INDIRECT OBSERVATIONS

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We consider a problem of the estimation of density of a random value that is an initial value of some dynamics. The dynamics is determined by the differential equation whose solution is observable at the end of an interval. By using a method of transformation of a measure along an integral curve in combination with kernel estimates, we present a procedure of the estimation of density.

SOME PARTICULAR PROPERTIES OF GENERAL ORTHONORMAL SYSTEMS

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The present paper are studied some particular properties of special series of Fourier coefficients of the class of functions of bounded variation, with respect to general orthonormal systems (ONS). Our results below demonstrate that, the properties of the general ONS and of the classical ONS (trigonometric ,Haar, Walsh system) are different in some cases.

DYNAMICAL PROBLEMS FOR A POROUS NONELASTIC CIRCLE WITH DOUBLE VOIDS

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The dynamics problems for a porous nonelastic circle with double voids are considered. These problems with the help of Laplace transformation with respect to time are reduced to problems of so called “pseudooscillation” the solutions of which are obtained in the form of series.

TO THE REALIZATION BY GAUSS-HERMITE APPROXIMATE METHOD FOR CAUCHY PROBLEM

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Let us consider the class of schemes corresponding to the Gauss-Hermite method for the approximate solution of Cauchy problems for the evolutionary equation. For realization of this process the important stage is possibility of solving approximately corresponding boundary value problems for the system of PDEs. For this aim the convergent iterative method is constructed.

POSITIVE INTEGERS NOT REPRESENTED BY A BINARY QUADRATIC FORM

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In this paper the formulae for the average number of representations of positive integers by a genus of positive binary quadratic forms are obtained. This allows us to establish the conditions when it is impossible to represent the positive integer by a binary form.

BAYESIAN CONSISTENT CRITERIA FOR WIENER PROCESS

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Existence of Bayesian [1] consistent criteria for Wiener process is investigated.

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BAYESIAN CONSISTENT CRITERIA FOR HYPOTHESES TESTING

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Existence of Bayesian consistent criteria for hypotheses testing is proved.

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STUDY OF STRENGTH OF A THICK-WALLED CIRCULAR CYLINDER BY USING PROBLEMS OF ELASTICITY STATICS

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The strength of a sufficiently long thick-walled homogeneous isotropic circular tube (cylinder) under the action of external forces is studied using the problems of elasticity statics. In particular, the minimum thickness of pipes with different materials and with different diameters are established, for which the obtained stresses do not exceed the permissible stresses values [1, 2]. The cylinder is in state of plane deformation, therefore two-dimensional boundary value problems for a circular ring are considered. Represented tables and graphs of minimum thickness of a circular ring when a) the normal constant stresses act at internal border, while the outer boundary is free of stresses and b) the normal constant stresses act at external border, while the inner boundary is free of stresses. For the numerical realization of the above mentioned problems solutions obtained by two means are used: the analytical solution obtained by the method of separation of variables, and Lamé's solution [1-3].

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