Summaries of all articles

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About MIPT activity in the field of preparation of the school students and teachers of advanced schools in physics and mathematics and interaction with the centers of additional education for gifted children

The problem of selection of the gifted children that are capable for studying at leading universities of the country and to a research work in the world of high technologies, can be solved by support of all forms of work with gifted children in the field of physics and mathematics, and also retrainings of school teachers, performing advanced and facultative work with school students. The article is devoted to MIPT experience in work with gifted and motivated school students and organizing extension courses for the school teachers of physics and mathematics.

Key words: advanced school education, school education in physics and mathematics, retraining of the school teachers, olympiads.

Maxim V. Balashov

The Lipschitz condition for the most farthest point in the Hilbert space.

In the present work we characterize such convex closed sets in the real Hilbert space, that for each of these sets the operator of metric antiprojection on the set (which gives for a given point of the space a subset of points of the set, which are most farthest from the given point of the space) is singleton and coincides the Lipschitz condition on the complementary to some neighborhood of the given set. We obtain new estimates of geometric properties of such set as function of the size of the neighborhood of the set and the Lipschitz constant for the antiprojection operator.

Key words: Hilbert space, strongly convex set of radius R, distance and antidistance functions, weak convexity.

A. A. Burtsev, S. B. Gashkov

On circuits for arithmetic in finite fields

In the work it is proved that for any $\varepsilon > 0$ for any m, $n = m^s$ and $s \geqslant s_\varepsilon$, you can choose in the field $GF(2^n)$ basis, for which the circuit complexity of multiplication of less than $n^{1+\varepsilon/2}$, and the difficulty of inverting is less than $n^{1+\varepsilon}$. At $n = 2 \cdot 3^k$ for some basis of the obtained for the multiplication of estimating complexity $n(\log_3 n)^{(\log_2 \log_3 n)/2 + O(1)}$ and in the order of magnitude of the same estimates are obtained for inverting.

Key words: boolean circuits, the complexity of schemes, arithmetics, finite fields.

O. V. Viskov

The ordered form of the quadratic exponential in the Heisenberg–Weyl algebra

We propose a new type of factorization of the exponential function, whose argument is a quadratic form in the generators of the Heisenberg–Weyl algebra.

Key words: canonical commutation relations, factorization, Ornstein–Uhlenbeck process, squeeze operator.

A. Ju. Golovko

Gagliardo–Nirenberg inequality for a domain with irregular boundary

Gagliardo–Nirenberg inequalities were established for domain with irregular boundary with the flexible σ-cone condition.

Key words: multiple inequality, weak derivative, domain with irregular boundary.

V. B. Goldshteyn

Grunbaum's problem for (0, 1)- and (-1, 0, 1)-polyhedrons in low dimensions

Examines Grunbaum's problem in low dimensions. Upper bounds was obtained for (0, 1)- and (-1, 0, 1)-polyhedrons using nontrivial algorithm.

Key words: Grunbaum's problem, ball covering, (0, 1)-polyhedron, algorithm, low dimension.

P. E. Dvurechensky, G. E. Ivanov

An algorithm for constructing of optimal strategy in a nonlinear differential game with a non-fixed completion time

We develop a method to compute quasioptimal strategies in a nonlinear differential game on a non-fixed time interval with a goal set. In two-dimensional case the play-attainable sets are calculated by an algorithm, similar to one for convolution of Minkowski's sum of two polyhedra. We provide detail error estimations of the algorithm.

Key words: differential game, optimal strategy.

A. I. Egorov, L. N. Znamenskaya

On the controllability of elastic oscillations of the system with free boundaries consistently connected objects with distributed parameters

Solve the problem of damping of the system consisting of m of series-connected objects with distributed parameters, the boundaries of the system — free. In one of the points compound objects with distributed parameters to the system attached to an object with concentrated parameters, using of which is oscillation damping system.

Key words: wave equation, boundary value problem, elastic oscillations, controllability, damping of oscillations.

A. V. Ershov, Th. Schick

Homotopy bundle gerbes

The goal of this paper is to define twisting cocycles for higher twisted K-theory. For this we generalize the approach to the twisted K-theory based on the notion of a bundle gerbe. In the present paper we define the notion of a homotopy bundle gerbe related to a homotopy transition cocycle with values in the monoid of endomorphisms of the direct limit of matrix algebras. On the set of such objects over a fixed base X we define a stable equivalence relation such that its equivalence classes are in one-to-one correspondence with homotopy classes of maps $X \to \mathrm{BBU}_\otimes[\frac{1}{l}]$ to the localization of the delooping of $\mathrm{BU}_\otimes$.

Key words: twisted K-theory, vector bundle, matrix algebra, classifying space, bundle gerbe, topological monoid

L. S. Efremova, A. S. Filchenkov

Topological Transitive Skew Product with a Negative Shvarcian of Fiber Maps

We separate the class of topologically transitive skew products of maps of an interval with a negative Schwarzian of the family of fibers maps. We prove the criterion of the destinguishing of topologically transitive maps the above class. This criterion is based on the property of the uniform approximability of the phase space by periodic orbits. Moreover, we construct the example of the skew product defined on the closed rectangle with the attractor with nonempty interior.

Key words: skew product, topological transitivity, attractor.

G. E. Ivanov, M. S. Lopushanski

Approximate properties of weakly convex sets in spaces with nonsymmetric seminorm

We consider the support conditions of strong and weak convexity with respect to a nonsymmetric seminorm. We obtain the theorem about the diameter of the epsilon-projection onto a set which satisfies the support condition of weak convexity and the existence and uniqueness theorem for the projection of a point from the Chebyshev layer of such a set. We prove the theorem which states that for two sets which satisfy the support condition of strong and weak convexity correspondingly and are sufficiently close to each other there exists a pair of nearest (in the sense of the nonsymmetric seminorm) points.

Key words: strong and weak convexity, metric projection.

G. M. Ivanov

Deviation of the convex hull of bounded sets

We study the maximal set's convex hull deviation (CHD) from the set provided that the set is contained in the unit ball. For the finite-dimensional space we obtain the exact upper bound of the CHD depending on the dimension of the space. We give an upper bound of the CHD via the Lipschitz constant of the metric projection operator onto the hyperplane. This Lipschitz constant, in turns, is bounded from above via the modules of smoothness and convexity of the space.

Key words: deviation of the convex hull, module of the supporting convexity.

A. Yaakbarieh, V. Zh. Sakbaev

On the presentation of semigroups generated by parabolic difference-differential equations by Feynman formulas

We establish that the Laplacian operator with perturbation by the symmetrised linear hall of displacement argument operators is the generator of unitary group in the Hilbert space of square integrable functions. The representation of semigroup of Cauchy problem solutions for considered functional differential equation is given by the Feynman formulas.

Key words: difference-differential equations, semigroup, Feynman formula, Chernoff theorem.

D. A. Markovtsev

Convergence conditions for iterative process of solving parametric programming problems using smooth penalty function method

This paper considers iterative process of solving parametric programming problems using smooth penalty function method. Convergence conditions for iterative solving process are formulated.

Key words: parametric programming, convergence conditions, smooth penalty function method, iterative process

Nguyen Le Linh

Sobolev problems for finite group actions

In this paper we consider a class of non-local Sobolev problems, associated with finite group actions on smooth manifolds. Using elliptic theory of translators and G-translators, we describe the ellipticity conditions, prove the finiteness theorem and give the index formula for these problems.

Key words: elliptic operators, boundary value problems for elliptic equations, stratified manifolds, G-translators, non-local Sobolev problem.

Yu. N. Orlov, A. D. Bosov

Kinetic and hydrodynamic approach to the non-stationary time series forecasting on the base of Fokker-Planck equation

The chain of kinetic equations for empirical high-dimension distribution functions is derived for non-stationary time series. The corresponding hydrodynamic system is constructed. The moment closing of this system enables to construct the time series model as a nonlinear dynamic system.

Key words: empirical distribution function, Liouville equation, Fokker-Planck equation, non-stationary time series.

E. S. Polovinkin

On some properties of derivatives of set-valued mappings

New classes of derivatives of set-valued mappings are investigated in the work. We obtain formulas for calculating them. Relations between the derivatives are established. The properties of epiderivatives of functions, hypoderivatives of functions and subdifferentials of arbitrary functions are studied. We obtained subdifferentials of functions representable as the difference of two convex functions.

Key words: tangent cone, Aubin derivative of multifunction, Clarke derivative, Penot derivative, epiderivatives of functions, hypoderivatives of functions, subdifferential.

S.A. Skinderev

Blocking strategies in laboratory cooperative games with implied bids

Cooperative game theory considers economical situations using the formation of characteristic functions. Usually, the theory gives sets of fair, in a sense, profit sharing, and offers particular selectors of noted sets. The inverse problem is investigated in this paper, i.e. the dynamic game is constructed for a specified characteristic function. The double auction with implied bids is offered as a mechanism. The main properties of the auction are described and the results of conducted laboratory experiments are discussed.

Key words: game theory, cooperative games, core, strictly balanced games, implied bids, blocking strategies, experimental economics, laboratory experiments, player awareness.

D.E. Syresin, T.V. Zharnikov, I.B. Petrov

Method for calculation of dispersion curves, wavefields and elastic parameters of the medium in boreholes with a radially inhomogeneous alteration zone

The radial inhomogeneity of elastic properties of rock formations in the vicinity of the borehole wall, caused by drilling, tectonic stresses or other factors, considerably affects the normal mode dispersion. The current work is devoted to the study of this influence on the flexural mode dispersion curve and radial profiles of stresses and displacements fields corresponding to this mode. Besides, the method of calculation of elastic properties within the alteration zone is proposed. It is based on the analysis and inversion of waveguides' dispersion curves. The proposed technique capabilities are illustrated by consideration of several models of boreholes with different types of inhomogeneity.

Key words: dispersion curves calculation, radially inhomogeneous media, matrix Riccati equation, radial profiling of boreholes.

D. A. Tereshin

Profile education in the solid geometry as a basis for training high school students in mathematical research

The features of the solid geometry course for mathematical classes in the context of teaching of mathematical research are considered.

Key words: profile education, solid geometry, mathematical research.

B. V. Trushin

Embedding of the weighted Sobolev spaces into the weighted Orlicz spaces and into the space of continuous functions on the anisotropic irregular domains

In this paper, classification by the parameter λ of domains with an anisotropic flexible σ-cone condition formerly introduced by the author is discussed. The author investigates the embedding of the weighted Sobolev spaces (in the ¡¡extreme¿¿ case) into the weighted Orlicz spaces and into the space of continuous functions on these classes of domains.

Key words: embedding theorem, Sobolev space, Orlicz space, irregular domain.

V. B. Trushin

One method for obtaining convergence rate estimates for certain approximations with monotone operators

In thus paper, we prove the convergence rate estimates of some approximation schemes with monotone operators.

Key words: monotony, variational inequality, convergence rate estimates.