ABSTRACTS

E.R. Andriyanova, F.Kh. Mukminov

The lower estimate of decay rate of solutions for doubly nonlinear parabolic equations

Abstract. Existence of strong solution to doubly nonlinear parabolic equation is established on unbounded domains by the method of Galerkin's approximations. In early publications existence was proved usually on bounded domains by approximating the evolution part of the equation by finite differences. Usage of Galerkin's approximations makes it possible to prove the second integral identity. On the basis of the identity, the bottom estimate of decay rate of the solution norm is proved on bounded domains. Similar estimates for quasilinear parabolic equations were established earlier by Tedeev A.F. and Alikakos N., Rostmanian R.

Keywords: doubly nonlinear parabolic equation, decay rate of solution, bottom estimates, existence of strong solution.

U.I. Baltayeva, B.I. Islomov

Boundary value problems for the loaded third order equations of the hyperbolic and mixed types

Abstract. In this paper, the unique solvability is proved for the solution of boundary value problems of a loaded third order differential equation with hyperbolic and parabolic-hyperbolic operators. The boundary value problems for loaded differential equations are reduced to the Volterra integral equation of the second kind. On this basis, existence and uniqueness of the solution of boundary value problems is proved by the method of integral equations.

Keywords:loaded equation, equations of the mixed type, integral equation, integral equation with a shift, Bessel's functions.

M.G. Gadoev

Spectral asymptotics of nonselfadjoint degenerate elliptic operators with singular matrix coefficients on an interval

Abstract. Some spectral asymptotic properties of the nonselfadjoint operator A associated with a noncoercive bilinear form in the space $\mathcal{H}^l = L_2(0,1)^l$ are investigated in the article. Such problems as summability of the Fourier series of elements $f \in \mathcal{H}^l$ with respect to the system of root vector-functions of the operator A by the Abel method with brackets, estimate for the resolvent of the operator A are considered.

Keywords: Elliptic differential operators, resolvent of operator, summability by the Abel method with brackets, system of root vector-functions.

R.R. Gadyl'shin, I.Kh. Khusnullin

Perturbation of the Shrödinger operator by a narrow potential

Abstract. A discrete spectrum of the Schrödinger operator perturbed by a potential on the real line is studied. The potential depends on two small parameters. One of the parameters describes the length of the support of the potential and the inverse of the other parameter corresponds to the magnitude of the potential.

Keywords: Schrödinger operator, perturbation, matching of asymptotic expansions

A.V. Zhiber, O.S. Kostrigina

Goursat problem for nonlinear hyperbolic systems with integrals of the first and second order

Abstract. We consider the Goursat problem for one class of nonlinear hyperbolic systems of equations of the form

$$u^i_{xy} = F^i(u, u_x, u_y),\ i = 1, 2,\ u = (u^1, u^2)$$

with integrals of the first and second order

$$\omega^1(u^1, u^2, u^1_x, u^2_x),\ \omega^2(u^1, u^2, u^1_x, u^2_x, u^1_{xx}, u^2_{xx}),\ (\bar{D}(\omega^1) = \bar{D}(\omega^2) = 0),$$
$$\bar{\omega}^1(u^1, u^2, u^1_y, u^2_y),\ \bar{\omega}^2(u^1, u^2, u^1_y, u^2_y, u^1_{yy}, u^2_{yy}),\ (D(\bar{\omega}^1) = D(\bar{\omega}^2) = 0).$$

Explicit formulas for the solutions of the Goursat problem with the data set on the characteristics

$$u^1(x_0, y) = \varphi_1(y),\quad u^2(x_0, y) = \varphi_2(y),$$
$$u^1(x, y_0) = \psi_1(x),\quad u^2(x, y_0) = \psi_2(x)$$

are obtained.

Keywords: nonlinear hyperbolic equations, characteristics, Goursat problem

B.E. Kanguzhin, D.B. Nurakhmetov, N.E. Tokmagambetov

Approximate properties of the root functions generated by the correctly solvable boundary value problems for higher order ordinary differential equations

Abstract. In this work properties of systems of root functions generated by the correctly solvable boundary value problems for higher order ordinary differential equations are studied. The biorthogonal systems of functions corresponding to the system of root functions are constructed. The resulting systems of root functions are minimal systems. The completeness of systems of root functions in $L_2(0, 1)$ is proved. The algorithm for the inverse problem is given by reconstruction of the boundary functions. Moreover, some identities are found for the eigenvalues of the considered operator.

Keywords: ordinary differential equations, the system of root functions, the biorthogonal system, the eigenvalues, the completeness of the system of functions, correctly solvable, boundary value problems, inner boundary conditions, nonlocal boundary conditions

A.Yu. Linkevitch, S.V. Spiridonov, G.A. Chechkin

On Boundary Layer of Newtonian Fluid, Flowing on a Rough Surface and Percolating Through a Perforated Obstacle

Abstract. In the paper we consider the behavior of electroconductive fluid percolating through a perforated obstacle and flowing over a rough surface. We consider a family of boundary value problems with a small parameter, in which the micro inhomogeneity concentrates on the boundary (the initial velocity profile depends on the small parameter and the surface along which the boundary layer is considered, is rapidly oscillating). The homogenized problem is obtained and the convergence of a solution of the initial problem to the solution of the homogenized problem is proved. Thus, the effective behavior of this microinhomogeneous fluid is described.

Keywords: Prandtl boundary layer, oscillating boundary, homogenization, asymptotics, Magnetohydrodynamical fluid

K.A. Mirzoev, T.A. Safonova

The singular Sturm-Liouville operators with nonsmooth potentials in a space of vector functions

Abstract. This paper deals with the Sturm-Liouville operators generated on the semi-axis by the differential expression $l[y] = -(y' - Py)' - P(y' - Py) - P^2 y$, where $'$ is a derivative in terms of the theory of distributions and P is a real-valued symmetrical matrix with elements $p_{ij} \in L^2_{loc}(R_+)$ $(i, j = 1, 2, \ldots, n)$. The minimal closed symmetric operator L_0 generated by this expression in the Hilbert space $\mathcal{L}^2_n(R_+)$ is constructed. Sufficient conditions of minimality and maximality of deficiency numbers of the operator L_0 in terms of elements of a matrix P are presented. Moreover, it is established, that the condition of maximality of deficiency numbers of the operator L_0 (in the case when elements of the matrix P are step functions with an infinite number of jumps) is equivalent to the condition of maximality of deficiency numbers of the operator generated by a generalized Jacobi matrix in the space l^2_n.

Keywords: Quasi-derivative, Sturm-Liouville operator, singular potential, distributions, generalized Jacobi matrices, deficiency numbers, deficiency index.

Zh.G. Rakhmatullina

The Fatou set of an entire function with the Fejér gaps

Abstract. The paper considers the Fatou set of an entire transcendental function, i.e. the largest open set of the complex plane where the family of iterations of the given function forms a normal family. We assume that the entire function, in general, is of an infinite order. We give the sufficient condition on the indexes of the series (it is stronger than the Fejér gap condition), under which every component of the Fatou set is bounded. The same result under stronger restrictions was earlier obtained by Yu. Wang.

Keywords: entire functions, Fejér gaps, iterations of functions, Fatou set

V.A. Sadovnichii, A.G. Chechkina

On estimate of eigenfunctions of the Steklov–type problem with a small parameter in the case of a limit spectrum degeneration

Abstract. We consider a Steklov–type problem with rapidly alternating boundary conditions (Dirichlet and Steklov) in a bounded two-dimensional domain. The parts of the boundary, where the Dirichlet boundary condition are given, have the length of the order ε and they alternate with parts of the length of the same order, having the Steklov condition. We prove that the normalized eigenfunctions for a sufficiently small ε satisfy the Friedrichs–type inequality with the constant of the order ε and moreover, they converge to zero as ε tends to zero.

Keywords: spectrum of operator, Steklov–type problem, homogenization, asymptotics

E.S. Smailov, A.I. Takuadina

About the unimprobality of the limiting embedding theorem for different metrics in the Lorentz spaces with Hermite's weight

Abstract. In this article we obtained inequality of different metrics in the Lorentz spaces with Hermit's weight for multiple algebraic polynomials. On this basis we established a sufficient condition of embedding of different metrics in the Lorenz spaces with Hermite's weight. Its unimprobality is shown in terms of the "extreme function". Let $f \in L_{p,\theta}(\mathbb{R}_n;\rho_n), 1 \leqslant p < +\infty, 1 \leqslant \theta \leqslant +\infty$. The sequense $\{l_k\}_{k=0}^{+\infty} \subset \mathbb{N}$ is such that $l_0 = 1$ and $l_{k+1} \cdot l_k^{-1} > a_0 > 1$, $\forall k \in \mathbb{Z}^+$. $f(\bar{x}) = \sum\limits_{k=0}^{+\infty} \Delta_{l_k,\dots,l_k}(f;\bar{x})$ is some presentation of the functions in the metric $L_{p,\theta}(\mathbb{R}_n;\rho_n)$, where $\Delta_{l_0,\dots,l_0}(f;\bar{x}) = T_{1,\dots,1}, \Delta_{l_k,\dots,l_k}(f;\bar{x}) = T_{l_k,\dots l_k}(\bar{x}) - T_{l_{k-1},\dots l_{k-1}}(\bar{x}), \forall k \in \mathbb{N}$. Here

$$T_{l_k,\dots l_k}(\bar{x}) = \sum_{m_1=0}^{l_k-1} \dots \sum_{m_n=0}^{l_k-1} a_{m_1,\dots,m_n} \prod_{i=1}^{n} x_i^{m_i} -$$

are algebraic polynomials for all $k \in \mathbb{Z}^+$.

1^0. If the series

$$A(f)_{p\theta} = \sum_{k=0}^{+\infty} l_k^{\tau\left(\frac{n}{2p}-\frac{n}{2q}\right)} \left\|\Delta_{l_k,\dots,l_k(f)}\right\|^{\tau}_{L_{p,\theta}(\mathbb{R}_n;\rho_n)}$$

converge under some q and τ: $p < q < +\infty$, $0 < \tau < +\infty$, then $f \in L_{q,\tau}(\mathbb{R}_n;\rho_n)$ and we have the inequality

$$\|f\|_{L_{q,\tau}(\mathbb{R}_n;\rho_n)} \leqslant C_{pq\theta\tau n} \times (A(f)_{p\theta})^{\frac{1}{\tau}}.$$

2^0. The condition 1^0 is unimprovable in the sense that there exists a function $f_0 \in L_{p,\theta}(\mathbb{R}_n;\rho_n)$ and $A(f_0)_{p\theta}$ diverges for it and $f_0 \notin L_{q,\tau}(\mathbb{R}_n;\rho_n)$.

At the same time, the function $f_0 \in L_{q-\varepsilon,\tau}(\mathbb{R}_n;\rho_n)$ for all $\varepsilon > 0 : p < (q-\varepsilon) < q$.

Keywords: Lorentz's space, Hermitte's weight, nonincreasing rearrangement, inequality of different metrics, theorem in embedding, non improving.

F.B. Khabibullin

Stability of sequences of zeros for classes of holomorphic functions of moderate growth in the unit disk

Abstract. Let $\Lambda = (\lambda_k)$ and $\Gamma = (\gamma_k)$ be two sequences of points in the unit disk $\mathbb{D} := \{z \in \mathbb{C}\colon |z| < 1\}$ of the complex plane $\mathbb{C}$, and H be a weight space of holomorphic functions on $\mathbb{D}$. Suppose that Λ is the zero subsequence of some nonzero function from H. We give conditions of closeness of the sequence Γ to the sequence Λ, under which the sequence Γ is the zero sequence for some holomorphic function from space $\hat{H} \supset H$. The space $\hat{H}$ can be a little larger than H.

Keywords: holomorphic function, unit disk, weight space, zero sequence, zero subsequence, shift of zeros, stability of zero sequence