ANNUAL REPORT ON SCIENTIFIC, AND SCIENTIFIC ORGANIZATIONAL ACTIVITY OF THE DEPARTMENT OF ”EQUATIONS OF MATHEMATICAL PHYSICS” OF INSTITUTE OF MATHEMATICS AND MECHANICS OF NAS OF AZERBAIJAN FOR THE YEAR OF 2017

In the department of "Equations of Mathematical Physics" 13 workers, 11 of whom are research workers. Of them 3 **doctors of sciences, professors, including one member of ANAS:**

1. Huseynov Rauf V. – head of department, chief research associate, corr-member of ANAS, (full time).
2. Akhundov Adalat Ya. – chief research associate, (a part time).
3. Mamedov Farman I. – chief research associate, (a part time).

7 doctors of philosophy in mathematics:

4. Guliyev Abdurrahim F. – leading research associate, (full time).
5. Bagirov Shirmail H. – leading research associate, assistant professor, (a part time).
6. Aliyev Mushfig J. – leading research associate, assistant professor, (full time).
7. Mamedov Elchin M. – senior research associate, (full time).
8. Shukurova Shahla Yu. – senior research associate, (full time).
9. Ismailova Sakina H. – senior research associate, (full time).
10. Hasanova Aynur H. – senior research associate, (full time).

1 kandidat for a degru:

11. Mammadli Sayali M. – junior research associate, (full time).

2 laboratory assistants:

12. Mustafayeva Lala M. – laboratory assistant, (full time).
13. Abdullayeva Aydan J. – laboratory assistant, (a part time).

I. SCIENTIFIC PART.

In the department 11 scientific works one carried out on the theme ”Unique solutions of mathematical physics problems and quality problems of solutions”.

Work 1: ”Estimation and application of the negative spectrum of quasielliptic operators”.

Executor: corr-member of ANAS, prof. R.V. Huseynov.

The spectrum for elliptic and some quasi-elliptic equations of high order was investigated. In particular, analogues of the stationary Schrödinger operator of high order are studied. In this case, a negative spectrum was considered for different types of differential operator and a given potential Q (x). We investigated what necessary conditions must be imposed on the potential, that the negative spectrum be finite and infinite.

Work 2: ”On the inverse problem for a class of elliptic equations”.

Executor: prof. A.Ya. Akhundov.

The inverse problem of determining the unknown coefficients on the right-hand side of the system of elliptic equations is investigated. The problem is solved by the method of successive approximations, the convergence of the approximate solution to the exact solution is proved, with the speed of the geometric series, the theorem on the existence, uniqueness, and stability of the solution is proved.

Published papers:

1. A.Ya. Akhundov, B.R. Selmkhanov Determination the coefficients in the right side of the system of elliptic equations. *Azerbaijan Journal of Mathematics, 2017, v.7, no.2, pp. 33-40.*

2. Ахундов А.Я., Гасанова А.И. Определение коэффициентов в правой части системы эллиптических уравнений. *Qoşqar Teymur oğlu Əhmədovun 100 illik yubileyinə həsr olunmuş “Riyaziyyat və Mexanikanın aktual problemləri” adlı Respublika elmi konfransının materialları, 2-3 noyabr, 2017, s. 163-164, Bakı ş., Bakı Dövlət Universiteti.*

3. Akhundov A.Ya., Hasanova A.H. Approximate solution of the inverse problem for semi-linear equation of parabolic type. *Akif Cəfər oğlu Hacıyevin anadan olmasının 80 illik yubileyinə həsr olunmuş ”Riyaziyyat və Mexanikanın müasir problemləri” adlı Beynəlxalq konfransın materialları, 6-8 dekabr 2017-ci il, Bakı ş., AMEA Riyaziyyat və Mexanika İnstitutu, pp. 19-20.*

Work 3: ”Compactness and boundedness problems for the Hardy operator in Lebesgue spaces with variable exponent. Weighted integral inequalities of Sobolev-Poincaré type. Qualitative properties of elliptic and parabolic equations (including divergent and non-divergent, linear and non-linear)”.

Executor: prof. F.I. Mamedov.

In the reporting period, work was completed on the study of the boundedness of the Hardy operator in Lebesgue spaces with variable exponent. An a priori estimate is proved for an operator estimating the action of the Lebesgue norm of a solution in the above-mentioned class of elliptic equations on the estimation of this solution by means of another Lebesgue norm. In addition, the necessary and sufficient conditions for the compact action of the Hardy operator in Lebesgue spaces with variable exponent are proved.

Published papers:

1. F. Mamedov, S. Monsurro, M.Transirico Potential Estimates and a Priori Estimates for Elliptic Equations of Cordes Type. *Azerbaijan Journal of Mathematics, 2017, v.7, no.1, pp. 92-104.*
2. F.Mamedov, S.Mammadli Compactness for the weighted Hardy operator in variable exponent spaces. *Comptes Rendus Mathematics, 2017, v.355. no.3, pp. 325 – 335.*
3. Farman Mamedov, Yashar Shukurov A Sawyer-type sufficient condition for the weighted Poincaré inequality. *Positivity, Springer International Publishing, 2017, pp. 1-13.*
4. Farman Mamedov, Sayali Mammadli A boundedness criterion for the conjugate Hardy operator in $L^{p(.)}$ (0, l). *Akif Cəfər oğlu Hacıyevin anadan olmasının 80 illik yubileyinə həsr olunmuş "Riyaziyyat və Mexanikanın müasir problemləri" adlı Beynəlxalq konfransın materialları, 6-8 dekabr 2017-ci il, Bakı ş., AMEA Riyaziyyat və Mexanika İnstitutu, p. 125.*
5. Farman Mamedov, Sayali Mammadli and Yusuf Zeren On some Hardy-Sobolev's type variable exponent inequality and its application. *Transactions issue mathematics Series of physical-technical & mathematics science of NAS of Azerbaijan, v. 37 (2017), no. 4.*

Work 4: "Boundary properties of solutions of second-order parabolic equations with variable coefficient".

Executor: A.F. Guliyev.

Using the value of the fundamental solution at the pole point of the cylindrical and paraboloid type regions and their side faces, we obtain the result of estimating the fundamental solution that plays an important role in the study of the qualitative properties of solutions parabolic equations of second-order of a non-divergent structure with variable coefficient.

Published papers:

1. Guliyev A.F The estimates of parabolic potential in special domains. *Akif Cəfər oğlu Hacıyevin anadan olmasının 80 illik yubileyinə həsr olunmuş "Riyaziyyat və Mexanikanın müasir problemləri" adlı Beynəlxalq konfransın materialları, 6-8 dekabr 2017-ci il, Bakı ş., AMEA Riyaziyyat və Mexanika İnstitutu, pp. 81-82.*
2. Guliyev A.F The estimates of parabolic potential in special domains. *Sumqayıt Dövlət Universitetinin yaradılmasının 55 illiyinə həsr olunan "Riyaziyyatın nəzəri və tətbiqi problemləri" Beynəlxalq Elmi konfransın materialları. Sumqayıt, 25-26 may, 2017, p. 115-116.*

Work 5: "The existence of positive global solutions of semilinear elliptic and parabolic equations in which junior derivatives participate".

Executor: ass. prof. Sh.H. Bagirov.

The problems of existence and non-existence of a global solution (defined almost everywhere) of second-order and fourth-order semilinear elliptic equations with a singular potential in the outer region of the ball containing the origin are studied.

At the same time, the question of the existence and absence of a global solution of the initial problem for semilinear parabolic equations and a system of equations in a cylindrical domain whose basis is the outer part of the sphere was investigated. In both cases, a sufficient condition is found for the absence of a global solution.

Published papers:

1. Ш.Г. Багыров, К. А. Гулиева Отсутствие положительных решений полулинейного эллиптического уравнения второго порядка с младшими производными и с сингулярным потенциалом. *Математическии заметки, 2017, том 101, выпуск 2, с. 313–317.*
2. Shirmail G. Bagirov The absence of global solutions of a system of semilinear parabolic equations with a singular potentialby. *Proceedings of the Institute of Mathematics and Mechanics, 2017, v.43, no.2, pp. 296-304.*
3. Sh.G. Bagirov, M.J.Aliyev The existence of global solutions of a semilinear parabolic equation with a singular potential. *Caspian journal of Applied Mathematics, Ecology and Economics, 2017, v.5, no.1, pp. 3-15.*
4. Ш.Г. Багыров Отсутствие положительных глобальных решений полулинейного параболического уравнения с сингулярным потенциалом. *Вестник БДУ, серия физико-математических наук, 2017, №1, с. 108-115.*

5. Ш.Г. Багыров Отсутствие решений полулинейно бигармонического уравнения с сингулярным потенциалом. *Математические заметки, том 103, выпуск 1, январь 2018 (çapdadır).*
6. Sh.G. Bagirov Absence of positive solution of a second order semilinear parabolic equation with periodic coefficients in time. *Akif Cəfər oğlu Hacıyevin anadan olmasının 80 illik yubileyinə həsr olunmuş "Riyaziyyat və Mexanikanın müasir problemləri" adlı Beynəlxalq konfransın materialları, 6-8 dekabr 2017-ci il, Bakı ş., AMEA Riyaziyyat və Mexanika İnstitutu, p. 53.*
7. Багыров Ш.Г., Кязымзаде Н.Н. Отсутствие глобальных решений полулинейного параболического уравнения. *Qoşqar Teymur oğlu Əhmədovun 100 illik yubileyinə həsr olunmuş "Riyaziyyat və Mexanikanın aktual problemləri" adlı Respublika elmi konfransının materialları, 2-3 noyabr, 2017, s. 165-166, Bakı ş., Bakı Dövlət Universiteti.*

Work 6: "The boundedness of the Hardy operator in Lebesgue spaces with variable exponent, its application to the qualitative properties of elliptic and parabolic equations".

Executor: ass. prof. M.J. Aliyev.

In the cylindrical region, whose base is the outer part of the sphere, the existence and absence of a global solution of the initial problem for a semilinear parabolic equation with a singular potential, the main part of which is the biharmonic operator, was investigated. A sufficient condition for the absence of a global solution was found.

Published papers:

Sh. Bagyrov, M.J. Aliyev, The existence of global solutions of a semi linear parabolic equation with a singular potential. *Caspian journal of Applied Mathematics, Ecology and Economics, 2017, v. 5, no.1, pp.3-15.*

Work 7: "Investigation of the qualitative properties of solutions of a class of nonlinear equations of pseudo-hyperbolic type".

Executor: E.M. Mamedov.

In the reporting period for the system of pseudo-hyperbolic equations with a linear and non-linear boundary condition, the problems of stabilization and destruction of the solution over a finite period of time were investigated.

The following problem is considered:

$$\begin{cases} u_{tt} + \Delta^2 u - \Delta u_t + \alpha u_t + f_1(u,v) = 0 \\ v_{tt} + \Delta^2 v - \Delta v_t + \beta v_t + f_2(u,v) = 0, (x,t) \in \Omega \times [0,T] \end{cases}, \tag{1}$$

$$u(x,0) = u_0(x), u_t(x,0) = u_1(x), x \in \Omega \quad , \tag{2}$$

$$v(x,0) = v_0(x), v_t(x,0) = v_1(x), x \in \Omega \quad , \tag{3}$$

$$\frac{\partial \Delta u}{\partial n} + \frac{\partial u}{\partial n} = g_1(u), (x,t) \in \partial\Omega \times [0,T] \quad , \tag{4}$$

$$\frac{\partial \Delta v}{\partial n} + \frac{\partial v}{\partial n} = g_2(v), (x,t) \in \partial\Omega \times [0,T] \quad , \tag{5}$$

here $\Omega \subset R^n$ is a bounded domain with a boundary $\partial\Omega$,
$u_0(x) \in W_2^1(\Omega), u_1(x) \in L_2(\Omega), i = 1,2, \alpha > 0$, $\beta > 0$ – some constants, $f_i(u,v)$ and $g_i(u), i = 1,2$ – non-linear functions, $\Delta^2 u = \Delta(\Delta u)$, $\partial / \partial n$ – outer normal to $\partial\Omega$.

For problem (1) - (5) the following theorem is proved:

Theorem. Suppose that the functions satisfy the following conditions:

1.
$$\left.\begin{aligned} G_1(u) &= \int_0^u g_1(s)ds \geq 0, \\ G_2(u) &= \int_0^u g_2(s)ds \geq 0, g_1(0) = g_2(0) = 0 \end{aligned}\right\} \tag{6}$$

$$\left.\begin{aligned} ug_1(u) - G_1(u) &\geq 0 \\ ug_2(u) - G_2(u) &\geq 0, для\ \forall u \in R^1 \end{aligned}\right\}$$

2. For any $\xi = (\xi_1, \xi_2) \in R^2$, inequality is performed:

$$f_1(\xi_1, \xi_2)\xi_1 + f_2(\xi_1, \xi_2)\xi_2 \geq F(\xi_1, \xi_2),$$

here $\forall (u, v) \in R^2$, F_1 и F_2 – are functions defined as follows:

$$F_1(u,v) = \int_0^u f_1(\xi_1, v)d\xi_1 , \ F_2(u,v) = \int_0^u f_2(u, \xi_2)d\xi_2 \ ;$$

3. For functions $F_i, i = 1,2$ the following condition is true:

$$F_i(u,v) \geq M(u^2 + v^2), \forall u, v \in R^2 . \tag{7}$$

Then for any $(u,v) \in W_2^1(0,T; W_2^2(\Omega)) \cap W_2^2(0,T; L_2(\Omega))$, this solution is stabilized:

$$\|u_t\|_{L_2} + \|u(x,t)\|_{W_2^1(\Omega)}, \|v_t\|_{L_2} + \|v(x,t)\|_{W_2^1(\Omega)} \to 0 , \text{ при } t \to \infty$$

Over a finite period of time, taking into account certain conditions imposed on the nonlinear functions given in the equation and boundary conditions, the destruction and stabilization of the solution with respect to t is investigated.

Published papers:

1. Mamedov E.M. Dördüncü tərtib psevdohiperbolik tənliklər sistemi üçün qoyulmuş qarışıq məsələnin həllinin stabilizasiyası. *Qoşqar Teymur oğlu Əhmədovun 100 illik yubileyinə həsr olunmuş "Riyaziyyat və Mexanikanın aktual problemləri" adlı Respublika elmi konfransının materialları, 2-3 noyabr, 2017, s. 212-213, Bakı ş., Bakı Dövlət Universiteti.*

2. Mamedov E.M. On behavior of solution of the nonlinear pseudohyperbolic equation of third order with nonlinear boundary condition in part of boundary. *Akif Cəfər oğlu Hacıyevin anadan olmasının 80 illik yubileyinə həsr olunmuş "Riyaziyyat və Mexanikanın müasir problemləri" adlı Beynəlxalq konfransın materialları, 6-8 dekabr 2017-ci il, Bakı ş., AMEA Riyaziyyat və Mexanika İnstitutu, pp. 123-124.*

Work 8: "On the existence and uniqueness of solutions of boundary value problems for equations with derivatives of fractional order".

Executor: Sh.Yu. Shukurova.

The paper is devoted to the study of the solution of the multipoint boundary value problem for the ordinary differential equation. A differential equation is considered, the order of whose derivatives are rational number and a certain step has been established for these derivatives.

Thus, the considered derivatives are represented with the help of integer multiples of the found step.

Consider the following equation:

$$D_{a_x}^{\frac{1}{2}}\ y(x) = D_{a_x}^{\frac{1}{3}}\ y(x),\quad x \in (a,b) \tag{1}$$

$$y(a) = \propto\ ,\quad y(b) = \beta\ ,\ y(x_0) = \gamma\ ,\ x_0 \in (a,\ b) \tag{2}$$

here $a > 0$, $b > x_0 > a$, $\alpha, \beta, \gamma \in R$.

If we take σ = 1/6, then equation (1) can be written in the following form:

$$D^{3\sigma} y(x) = D^{\sigma} \qquad y = (x)\ ,\quad x \in (a,b) \tag{3}$$

$$\Delta=\begin{vmatrix} \frac{a^{-\frac{5}{6}}}{\left(-\frac{5}{6}\right)!} & \cdot \frac{a^{-\frac{4}{6}}}{(-\frac{4}{6})!} & \cdot \sum_{k=0}^{\infty} \frac{a^{\frac{13k}{6}-1}}{\left(\frac{13k}{6}-1\right)!} \\ \frac{b^{-\frac{5}{6}}}{(-\frac{5}{6})} & \cdot \frac{b^{-\frac{4}{6}}}{(-\frac{4}{6})} & \cdot \sum_{k=0}^{\infty} \frac{b^{\frac{13k}{6}-1}}{\left(\frac{13k}{6}-1\right)!} \\ \frac{x_0^{-\frac{5}{6}}}{\left(-\frac{5}{6}\right)!} & \cdot \frac{x_0^{-\frac{4}{6}}}{\left(-\frac{4}{6}\right)!} & \cdot \sum_{k=0}^{\infty} \frac{x_0^{\frac{13k}{6}-1}}{\left(\frac{13k}{6}-1\right)!} \end{vmatrix} \neq 0 \qquad (4)$$

The following result is obtained:

Theorem. If $b > x_0 > a > 0$, $\forall \alpha, \beta, \gamma \in R$ and condition (4) is satisfied, then problem (1) - (2) has a unique solution:

$$y(x) = C_1 \frac{x^{\sigma-1}}{(\sigma-1)} + C_2 \frac{x^{2\sigma-1}}{(2\sigma-1)!} + C_0 \sum_{k=0}^{\infty} \frac{x^{k\sigma-1}}{(k\sigma-1)!} \ ,$$

here the constants C_0, C_1, C_2 are determined by the condition (2).

Work 9: "Strong solvability of the mixed boundary value problem for second-order parabolic equations of a non-divergent structure in the Sobolev's spaces".

Executor: S.H. Ismailova.

In the reporting period, the existence of a solution of the mixed boundary value problem for parabolic second-order equations of a non-divergent structure in Sobolev's spaces was investigated. Here, the Cordes's condition is imposed on the coefficients of the principal part of the parabolic equation, and the condition of belonging to the corresponding Lebesgue spaces is imposed on small coefficients.

For quasi-linear second-order parabolic equations of a non-divergence structure with discontinuous coefficients, the following mixed boundary value problem is considered:

$$\mathcal{M}u = \sum_{i,j=1}^{n} a_{ij}(t,x,u,u_x)u_{ij} + b(t,x,u,u_x) - u_t = 0 \ ; \qquad (1)$$

$$u|_{t=0} = 0, \ \frac{\partial u}{\partial n}\Big|_{S_T} = 0 \ , \qquad (2)$$

where $\|a_{ij}(t,x,z,v)\|$ is an arbitrary real symmetric matrix whose elements for $z \in E_1, v \in E_n$ belong to Q_T and

$$\mu|\xi|^2 \leq \sum_{i,j=1}^{n} a_{ij}(t,x,z,v)\xi_i\xi_j \leq \mu^{-1}|\xi|^2 \ , \qquad (3)$$

$$(t,x) \in Q_T, z \in E_1, v \in E_n, \xi \in E_n, \mu \in (0,1] - const,$$

$$\sigma = ess\ sup \frac{\sum_{i,j=1}^{n} a_{ij}^2(t,x,z,v)}{\sum_{i=0}^{n}[a_{ii}(t,x,z,v)]^2} < \frac{1}{n-1}, \quad (4)$$

$W_p^{2,1}(Q_T)$ is the Banach space of measurable functions in Q_T.

We denote by $\overset{\circ}{W}{}_p^{2,1}(Q_T)$ the set of functions in $C^\infty(\bar{Q}_T)$, that is dense in $W_p^{2,1}(Q_T)$, satisfying the conditions $u|_{t=0} = 0$, $\left.\frac{\partial u}{\partial n}\right|_{S_T} = 0$ with the norm

$$\|u\|_{\overset{\circ}{W}{}_p^{2,1}(Q_T)} = \left(\int_{Q_T} \left(|u|^p + \sum_{i=1}^{n} |u_i|^p + \sum_{i,j=1}^{n} |u_{ij}|^p + |u_t|^p \right) dtdx \right)^{\frac{1}{p}}, \qquad p \in (1,\infty)$$

The function $u(t,x) \in W_p^{2,1}(Q_T)$, $p \in (1,\infty)$, satisfying equation (1) almost everywhere is called a solution of problem (1) - (2) that is strong almost everywhere. The additional conditions are imposed on the coefficients of the operator M besides conditions (3) and (4). Taking these conditions into account, the strong solvability of problem (1) - (2) is investigated in the $\overset{\circ}{W}{}_p^{2,1}(Q_T)$ domain.

Work 10: "An approximate solution of the inverse problem for a system of parabolic equations".

Executor: A.H. Hasanova.

The paper is devoted to the study of the approximate solution of the inverse problem on the determination of unknown coefficients on the right-hand side of the system of parabolic equations.

For a system of parabolic equations of the reaction-diffusion type of the form

$$u_{kt} - \Delta u_k = f_k(t) g_k(x,t,u),\ k = \overline{1,m}$$

the following inverse problem is considered:

It is required to determine $\{f_k(t), u_k(x,t), k = \overline{1,m}\}$ from the conditions:

$$u_{kt} - \Delta u_k = f_k(t) g_k(x,t,u), (x,t) \in \Omega = D \times (0,T], \quad (1)$$

$$u_k(x,0) = \varphi_k(x),\ x \in \overline{D} = D \cup \partial D, \quad (2)$$

$$\frac{\partial u_k}{\partial \overline{N}} + b_k(t) u_k = \psi_k(x,t),\ (x,t) \in S, \quad (3)$$

$$\int_D u_k(x,t)dx = q_k(t), t \in [0,T], \quad (4)$$

by specified functions $g_k(x,t,p)$, $\varphi_k(x)$, $b_k(t)$, $\psi_k(x,t)$, $q_k(t)$, $k = \overline{1,m}$.

We assume that the input data of the problem satisfy the following conditions for $k = \overline{1,m}$:

1^0. $g_\kappa(x,t,p) \in C^{\alpha,\alpha/2}\left(\overline{\Omega}\times R^m\right)$;
2^0. $\varphi_k(x)\in C^{2+\alpha}\left(\overline{D}\right)$;
3^0. $\psi_k(x,t)\in C^{\alpha,\alpha/2}(S)$, $b_k(t)\in C^{\alpha}[0,T]$;
4^0. $q_k(t)\in C^{1+\alpha}[0,T]$.

For an approximate solution of the inverse problem, the method of successive approximations is applied and justified. A theorem on the uniqueness of the solution, the uniform convergence of the approximate solution to the exact solution with the speed of a geometric progression, is proved.

The main result of the paper is formulated as the following theorem: **Theorem.** Let:

1) conditions 1^0, 2^0, 3^0, 4^0 are satisfied;
2) the problem has a unique solution belonging to the correctness set K^α :

$$K^\alpha = \{(f_k,u_k) \mid f_k(t)\in C^\alpha[0,T], |f_k(t)|\le c_5,\ t\in[0,T],$$

$$u_k(x,t)\in C^{2+\alpha,1+\alpha/2}(\overline{\Omega}), \left|D_x^l u_k(x,t)\right|\le c_6,\ l=0,1,2,\ (x,t)\in\overline{\Omega},\ k=\overline{1,m}\};$$

3) $f_k^{(0)}(t)\in C^\alpha[0,T]$, $u_k^{(0)}(x,t)\in C^{2+\alpha,1+\alpha/2}\left(\overline{\Omega}\right)$, $k=\overline{1,m}$.

Then the functions found by the method of successive approximations uniformly tend to the solution of problem (1) – (4) with the speed of geometric series.

Published papers:

1. Гасанова А.Г. О приближенном решении обратной задачи для системы параболических уравнений типа реакция-диффузия. *Математика и математическое образование. Сборник трудов VIII Международной научной конференции «Математика. Образование. Культура» (к 240-летию со дня рождения Карла Фридриха Гаусса), Изд. ТГУ, г. Тольятти, 26-29 апреля, 2017, с. 292-294.*

2. Həsənova A.H. Vətənpərvər alim, istəkli müəllim. *”Elm və Həyat”, Elmi-populyar jurnal, Bakı, 2016, № 4, s. 91-93. (2017-də çap olunmuşdur).*

3. Aliyev A.B., Hasanova A.H. On the pulsating flow of the viscous noncompressible fluid in a multilayer viscoelastic semi-infinite tube. *”Science and World”, International scientific journal, № 8 (48), Volgograd, 2017, Publishing House ”Scientific survey”, Global Impact Faktor-0,325, Australia, pp. 13-14.*

4. V.A. Bayramov, R.T. Aliyev, Hasanova A.H. Constructing integro-differential equation for the Gerber-Shiu function in Erlang (n) insurance risk model with constant interest rate. *”Transactions” of Azerbaijan National Academi of Sciences, Series of Physical-Technical and Mathematical Sciences, Informatics and control problems, v. XXXVII, no. 3, Baku, 2017, ”Elm” Publishers, pp. 64-68.*

5. Ахундов А.Я., Гасанова А.Г. Определение коэффициентов в правой части системы эллиптических уравнений. *Qoşqar Teymur oğlu Əhmədovun anadan olmasının 100 illik yubileyinə həsr olunmuş "Riyaziyyat və Mexanikanın aktual problemləri" adlı Respublika Elmi konfransın materialları, 2-3 noyabr, 2017- ci il, s. 163-164, Bakı ş., Bakı Dövlət Universiteti.*
6. Ахундов А.Я., Гасанова А.Г. Приближенное решение одной обратной задачи для полулинейного уравнения параболического типа. *Akif Cəfər oğlu Hacıyevin anadan olmasının 80 illik yubileyinə həsr olunmuş "Riyaziyyat və Mexanikanın müasir problemləri" adlı Beynəlxalq konfransın materialları, 6-8 dekabr 2017-ci il, Bakı ş., AMEA Riyaziyyat və Mexanika İnstitutu, pp. 19-20.*
7. V.A. Bayramov, R.T. Aliyev, A.H. Hasanova Construction of integro-differential equation for the Gerber-shiu function in gamma insurance risk model with constant interest rate. *III Международная научно-практическая конференция под названием «Математическое моделирование в экономике, управлении и образовании», 16-17 ноября, 2017 год, г. Калуга, Калужский филиал Финансового университета, Изд. ООО «ТРП», г. Москва, с. 3-5.*
8. A.H. Həsənova Vətənin fazil insanı – müəllim. *525-ci qəzet, 18 noyabr 2017-ci il, № 211 (4948), s. 14.*

Work 11: "The study of difference weight inequalities of Hardy type".

Executor: S.M. Mammadli.

A one-dimensional weighted inequality of Hardy type of fractional order was proved:

$$\int_0^\infty u(t)^p v(t) t^{n-1} dt \le C \int_0^\infty \left(\int_0^t \left(u(x) - u(t)\right)^p \omega(t-x) x^{n-1} dx \right) t^{n-1} dt \, .$$

For a monotonically decreasing function u, the conditions $u(\infty) = 0$ $(0, \infty) \to (0, \infty)$, and the weight function has the form:

$$v(t) = \int_t^\infty \omega(s) s^{n-1} ds \, .$$

Published papers:

1. F. Mamedov, S. Mammadli Compactness for the weighted Hardy operator in variable exponent spaces. *Comptes Rendus Mathematics, 2017, v. 355. no.3, pp. 325 – 335.*

2. F. Mamedov, S. Mammadli A boundedness criterion for the conjugate Hardy operator in $L^{p(.)}$ (0, l). *Akif Cəfər oğlu Hacıyevin anadan olmasının 80 illik yubileyinə həsr olunmuş "Riyaziyyat və Mexanikanın müasir problemləri" adlı Beynəlxalq konfransın materialları, 6-8 dekabr 2017-ci il, Bakı ş., AMEA Riyaziyyat və Mexanika İnstitutu, p. 125.*

3. Farman Mamedov, Sayali Mammadli and Yusuf Zeren On some Hardy-Sobolev's type variable exponent inequality and its application. *Transactions issue mathematics Series of physical-technical & mathematics science of NAS of Azerbaijan, v. 37 (2017), no. 4.*

II. ORGANIZATIONAL ACTIVITY.

Thad of the department, corr. member of ANAS, prof. Rauf Huseynov is a member of Scientific Council, Dissertation Board and a member of editorial staff of scientific journals «TRANSACTIONS» and «PROCEEDINGS» of ANAS. The gives lectures to masters of IMM on "Contemporary problems of mathematics".

Cheif research associate of the department prof. Adalat Akhundov is a member of Scientific Council, vice-chairman of Dissertation Board, a member of the editorial staff of the journal «PROCEEDINGS» of Baku University for girls.

Cheif research associate of the department prof. Farman Mamedov is a member of the Expert Commission of HCC, a member of editorval board of Azerbaijan and foreign journals, a reviewer of the journal of «Mathematical Reviews of American Mathematical Society».

Leading research associates of the department Abdurrahim Guliyev and ass. prof. Shirmail Bagirov are the member of the Scientific Subject Seminar.

R.V. Huseynov, A.Ya. Akhundov, F.I. Mamedov, A.F. Guliyev, Aliyev M.J. were opponents of dissertation works.

Employees of the department participated in the general seminar of the Institute throughout the year, the main research assistant Professor Farman Mammadov spoke on November 22, 2017 at the seminar on the topic "Qualitative properties of a class of non-uniformly degenerate elliptic equations".

Every week on wednesday, traditionally carries out its work seminar of the department, led by corr-member of ANAS, professor Rauf Huseynov.

KONFERENCES

1. The employee of the department Guliyev A.F. took part in the International Scientific Conference "Theoretical and Applied Problems of Mathematics", dedicated to the 55th anniversary of the formation of the Sumgait State University, held May 25-26, 2017.
2. Employees of the department Akhundov A.Ya., Bagirov Sh. H., Mamedov E.M., Hasanova A.H. participated in the Republican Scientific Conference entitled "Actual problems of mathematics and mechanics" dedicated to the 100th anniversary of the birth of Koshkar Teymur oglu Akhmedov, held at the Baku State University on November 2-3, 2017.
3. Employees of the department Akhundov A.Y, Mamedov F.I, Guliev A.F, Mamedov E.M, Mammadli S.M, Hasanova A.H took part in the International Scientific Conference "Modern Problems of Mathematics and Mechanics" dedicated to the 80th anniversary of the birth of Akif Jafar oglu Gadjiyev, held at the Institute of Mathematics and Mechanics of NAS of Azerbaijan on December 6-8, 2017.

SCIENTIFIC PROFESSIONAL TRIPS

On October 1-9 collaborator of the department prof. Farman Mamedov was on a professional trips in Turkey and gave lectures in Technical University Yildiz on the obtained rezults of his scientific research work.

Professor Farman Mammadov continues cooperation with Italian scientists.

Thus, in 2017, collaborators of the department published 13 papers (2 papers are included in the journals from the list of Thomson Reuters), 11 abstracts, 6 papers are represented for publication.

Head of department: **corr-member of ANAS, d.f.-m.s., prof. R.V. Huseynov.**