

# **REPORT ON SCIENTIFIC ACTIVITY OF THE DEPARTMENT OF "EQUATIONS OF MATHEMATICAL PHYSICS" OF IMM ANAS FOR THE YEAR OF 2016**

In the department of "Equations of mathematical physics" work **3 doctors sciences, professors including one corr-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. Quliyev 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. – research associate, (full time).

## **1 kandidat for a degru**

11. Mamedli Sayali M. – junior research associate, (full 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: "Investigating a negative spectrum of quasielliptic operators.**

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

Some problems for general quasielliptic operators are studied, some cases of finiteness and infiniteness of a negative spectrum were researched, some results for elliptic and weighted elliptic operators were studied. Theorems on finiteness and

infiniteness of a negative spectrum of quasi-elliptic operators were obtained, a theorem on estimation of the number of spectra was proved.

### **Published papers**

R.V. Huseynov, A.Ya. Akhundov. On an inverse problem for a "weak" system of parabolic equations. *AMEA Məruzələr, № 1, Bakı, 2016.*

### **Work 2: "On inverse problem for a "weak" system of elliptic equations".**

**Executor: prof. A.Ya. Akhundov.**

Well-posedness of the inverse problem for finding the unknown right hand side of the system of elliptic equations was studied. A theorem on uniqueness and "conditional" stability of the solution is proved, an algorithm for finding approximate solution, of the problem under consideration is grounded.

### **Published papers**

1. A. Ya. Akhundov. On an inverse problem for an elliptic equation. *Международная конференция, посвящённая 110-летию Я.Б. Лопатинского, Львов, 20-24 сентября, 2016.*
2. А. Я. Ахундов, А.И. Гасанова. Коэффициентные обратные задачи для полулинейных параболических уравнений. *Prof. Ə. Həbibzadənin 100 illiyinə həsr olunmuş "Funksional analiz və onun tətbiqləri" adlı Beynəlxalq Elmi konfransın materialları. Bakı, 9-10 iyun, 2016.*
3. A. Ya. Akhundov, A.İ. Gasanova. On an inverse problem for a semilinear parabolic equation in the case of boundary value problem with nonlinear boundary condition. *Akad. M. Rəsulovun 100 illiyinə həsr olunmuş "Nəzəri və tətbiqi riyaziyyatın aktual məsələləri" Respublika Elmi Konfransının materialları, 2016, 28-29 oktyabr, Şəki, s. 31-33.*
4. А. Я. Ахундов. Определение коэффициентов в правой части смешанных эллиптических уравнений. *Международная конференция, посвящённая 110-летию акад. А.Н. Тихонова, 31 октябрь-3 ноябрь, 2016.*
5. A. Ya. Akhundov, A.İ. Gasanova. Determination of the coefficient of a "weak" system of parabolic equations. *International Workshop on Non-Harmonic Analysis and Differential Operators, Abstracts, Baku, Azerb., 25-27 May, 2016, p. 9-11.*
6. R.V. Huseynov, A.Ya. Akhundov. On an inverse problem for a "weak" system of parabolic equations. *AMEA Məruzələr, № 1, Bakı, 2016.*

### **Work 3: "Studying different integral inequalities of imbedding type and their application to investigation of quality problems for partial differential equations".**

**Executor: prof. F.I. Mamedov.**

Estimation of the Lebesgue norm for the function  $u$  by the another Lebesgue norm of the value of elliptic operators over the same function was proved for non-divergent linear elliptic equations with discontinuous coefficients satisfying the Cordes condition.

Some a priori estimation for non-divergent linear differential equations with discontinuous coefficients was proved. The estimation of the Lebesgue norm  $u$  by another norm of the value of elliptic operator over the same function is given for arbitrary function. There the coefficients satisfy the weaker a condition than the Cordes condition, the coefficient are bounded measurable functions satisfying the condition of uniform ellipticity.

#### **Published papers**

1. F. Mamedov, S. Monsurrò, M. Transirico. [Potential estimates and a priori estimates for elliptic equations of Cordes type](#), *Azerbaijan Journal of Mathematics*, Print ISSN: 2218-6816, Online ISSN: 2221, 2016, 7 pages.
2. F. I. Mamedov, Y. Zeren. [On boundedness of fractional maximal operator in weighted  \$L\_p\(\cdot\)\$  spaces](#), *Mathematical Inequalities and Applications* 19 (1), 1-14, 2016.
3. F. Mamedov, S. Monsurrò, M. Transirico. [An application of potential estimates to a priori bounds for elliptic equations](#), *Abstract and Applied Analysis*, Volume 2016 (2016), Article ID 6463030, 6 pages.
4. F. Mamedov, Salmanova Sh.Y. On strong solvability of the Dirichlet problem for semi linear elliptic equations with discontinues coefficients. *International Workshop on Non-Harmonic Analysis and Differential Operators, Abstracts, Baku, Azerb., 25-27 May, 2016, p. 71-72.*
5. F. Mamedov, S.M. Mamedli. On the fractional order weighted Hardy inequality for monotone functions. *Proceedings of the Institute of Mathematics and Mechanics, National Academy of Sciences of Azerbaijan. Volume 42, number 2, p. 257-264.*

### **Work 4: "Quality properties of solutions of second order parabolic equations with discontinuous coefficients".**

**Executor: A.F. Quliyev.**

Internal and boundary quality properties of solutions of second order parabolic equations with discontinuous coefficients are studied. The growth type theorems characterizing the growth of nonnegative solvability were proved, their application was considered.

**Published papers**

A.F. Quliyev. On equivalence of Petrovsky and Wiener criteria for the parabolic equation. *International Workshop on Non-Harmonic Analysis and Differential Operators, Abstracts, Baku, Azerb., 25-27 May, 2016, p. 92.*

**Work 5: "Existence of positive global solutions of semi-linear elliptic and parabolic equations with minor derivatives".**

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

A problem on the existence of positive global solution of second order equation with singular coefficients was studied on the exterior domain of a ball. Estimation for nonexistence of positive global solution was found. Exactness of the found estimation was shown.

**Published papers**

Sh.H. Bagirov, M.J. Aliyev. On absence of solutions of a semi-linear elliptic equation with biharmonic operator in the exterior of a ball. *ANAS, TRANSACTIONS ISSUE MATHEMATICS, № 36(4), p. 63-69, Baku, 2016.*

**Work 6: "Studying some weight inequalities for integral operators in Lebesgue spaces with variable index".**

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

A priori estimations for linear elliptic equations with discontinuous coefficients of second order were obtained. Boundedness of Hardy-Littlewood's maximum operator in Lebesgue space with variable exponent was studied. A semi-linear biharmonic equation containing the origin of coordinates in the exterior domain of a compact, was considered. Estimation for no positive global solution was found and exactness of then estimation was shown.

### **Published papers**

Sh.H. Bagirov, M.J. Aliyev. On absence of solutions of a semi-linear elliptic equation with biharmonic operator in the exterior of a ball. *ANAS, TRANSACTIONS ISSUE MATHEMATICS, № 36(4), p. 63-69, Baku, 2016.*

**Work 7: "Studying quality properties of solvability of the stated initial boundary value problem for pseudo-hyperbolic type nonlinear equations".**

**Executor: E.M. Mamedov.**

A problem of stabilization of the solution for a fourth order pseudo-hyperbolic equation with nonlinear boundary condition was considered.

### **Published papers**

1. Э.М. Мамедов. Об одной смешанной задаче для псевдогиперболического уравнения четвертого порядка. *Prof. Ə. Həbibzadənin 100 illiyinə həsr olunmuş "Funksional analiz və onun tətbiqləri" beynəlxalq elmi konfransının materialları, Bakı, 2016, 9-10 iyun, s. 166-168.*

2. Э.М. Мамедов. Об одной задаче для нелинейного псевдогиперболического уравнения четвертого порядка. *Akad. M. Rəsulovun 100 illiyinə həsr olunmuş "Nəzəri və tətbiqi riyaziyyatın aktual məsələləri" Respublika Elmi Konfransının materialları, 2016, 28-29 oktyabr, Şəki, s. 210-212.*

**Work 8: "Studying solutions of boundary value problems for fractional equations".**

**Executor: Sh.Yu. Shukurova.**

A differential equation whose derivative is a rational number is considered. For solving by means of Mittag-Leffler function, invariant functions for fractional derivative was used. Analytic expression for solving a boundary value problem was obtained. Existence and uniqueness of the solution of the boundary value problem was shown.

### **Published papers**

1. Sh.Y. Shukurova, A.N. Aliyev. On uniqueness of solution to n-th order ordinary linear differential equation. *Trans.of NAS of Azerb.Ser.of phys.-techn.and math.sci.-2016, v. XXXVI, №1, p. 25-28.*

2. F. Mamedov, Salmanova Sh.Y. On strong solvability of the Dirichlet problem for semi linear elliptic equations with discontinues coefficients. *International Workshop on Non-Harmonic Analysis and Differential Operators, Abstracts, Baku, Azerb., 25-27 May, 2016, p. 71-72.*

**Work 9: "Studying existence of solution to the mixed boundary value problem stated for second order parabolic equation of non-divergent structure in appropriate Sobolev space".**

**Executor: S.H. Ismailova.**

Existence of strong unique solution (of almost everywhere) solution of a mixed boundary value problem is studied for non-divergent quasi-linear parabolic equations of second order with discontinuous coefficient in cylindrical domain of Sobolev space. Here the Cordes conditions are imposed on the coefficients of the principal part, the condition of belonging to appropriate Lebesgue space is imposed on small coefficients.

**Work 10: "On an inverse problem for "weak" system of parabolic equations".**

**Executor: A.H. Hasanova.**

Well-posedness in Tikhonov's sense of a class of inverse problem was studied. A theorem on uniqueness and "conditional" stability of the solution was proved, an algorithm for approximate solution of the considered problem is grounded.

### **Published papers**

1. A.H. Həsənova. Diferensiallanan funksiyaların bir mühüm xassəsi haqqında. Bakı Qızlar Universitetinin mətbəəsi, Elmi əsərlər, №1 (25), Bakı, 2016, s. 174-176.
2. Aslanov H.İ., Yüzbəyov R.Ə., Əliyeva L.R., A.H. Həsənova. İnteqral çevirmələri nəzəriyyəsinin elementləri. Azərbaycan Texniki Universitetinin mətbəəsi, Bakı, 2016, 161 s.
3. А.Г. Гасанова. Решение обратных задач методом последовательных приближений. Издательство Азербайджанского Технического Университета, Научно-технический журнал "Ученые записки", том 2, № 2, 2016, стр. 142-149.
4. Mərdanov M.C., A.H. Həsənova. Görkəmli alim və şəxsiyyət. 525-ci qəzet, Bakı, 2016, 2 iyul, №118 (4614), s. 10 -11.

5. Mərdanov M.C., A.H. Həsənova. Görkəmli alim və şəxsiyyət. "Elm və Həyat", Elmi-populyar jurnal, Bakı, 2016, № 2 (457), s. 40-44, AMEA-nın "ELM" nəşriyyatının mətbəəsi.
6. A.H. Həsənova. Sələflərimizi unutmayın. 525-ci qəzet, № 212 (4708), Bakı, 2016, 19 noyabr, s. 15.
7. A. Ya. Akhundov, A.İ. Gasanova, On an inverse problem for a semilinear parabolic equation in the case of boundary value problem with nonlinear boundary condition. *Akad. M. Rəsulovun 100 illiyinə həsr olunmuş "Nəzəri və tətbiqi riyaziyyatın aktual məsələləri" Respublika Elmi Konfransının materialları, 2016, 28-29 oktyabr, Şəki, s. 31-33.*
8. A. Ya. Akhundov, A.İ. Gasanova. Determination of the coefficient of a "weak" system of parabolic equations. *International Workshop on Non-Harmonic Analysis and Differential Operators, Abstracts, Baku, Azerb., 25-27 May, 2016, p. 9-10.*
9. А. Я. Ахундов, А.И. Гасанова. Коэффициентные обратные задачи для полулинейных параболических уравнений. *Prof. Ə. Həbibzadənin 100 illiyinə həsr olunmuş "Funksional analiz və onun tətbiqləri" adlı Beynəlxalq Elmi konfransın materialları. Bakı, 9-10 iyun, 2016.*

**Work 11: "Studying difference weight inequality of Hardy type".**

**Executor: S.M. Mamedli.**

The weight Hardy fractional inequality is proved for monotone decreasing function tending to zero at infinity in one-dimensional case.

**Published papers**

F. Mamedov, S.M. Mamedli. On the fractional order weighted Hardy inequality for monotone functions. *Proceedings of the Institute of Mathematics and Mechanics, National Academy of Sciences of Azerbaijan, Volume 42, number 2, p. 257-264.*

**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".

Chief 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.

Chief research associate of the department prof. Farman Mamedov is a member of the Expert Commission of HCC, a member of editorial 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 were opponents of dissertation works.

Collaborators of the department Huseynov R.V. and Akhundov A.Ya. were the participants of the project "Inverse problems for "weak" system of stationary and nonstationary parabolic equations" (02.2015-08.2016).

The obtained results of the project were represented at in the seminar of the chair of "Mathematics" of the faculty of "Physics" and in computing center of the chair "Computing mathematics" in the seminar "Ill posed and inverse problems".

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

## **KONFERENCES**

1. Akhundov A.Ya., Mamedov F.I., Guliyev A.F., Bagirov Sh.H., Shukurova Sh.Yu., Hasanova A.H., Mamedli S.M. participated at the International Workshop "Non-Harmonic Analysis and Differential Operators" held in IMM ANAS in May 25-27, 2016.
2. Akhundov A.Ya., Mamedov E. M., Hasanova A.H. represented their lecture, participated at the International Conference "Functional analysis and its applications" held in Baku State University on June 9-10 devoted to 100 years of prof. A. Habibzadeh.
3. Akhundov A.Ya., Mamedov E. M., Hasanova A.H. represented their lecture, participated at the Republican Conference "Urgent problems of theoretical and applied mathematical" held on October 28-29 devoted to 100 years of acad. M. Rasulov.
4. Prof. Akhundov A.Ya. in september gave a talk at the International Conference held in Lvov city (Ukraine) devoted to 110 years of acad. B.Ya. Lopatinskiy.
5. Prof. Akhundov A.Ya. represented their lecture at International Conference devoted to 110 years of acad. A.N. Tikhonov held in October 31-November 3.



## **SCIENTIFIC PROFESSIONAL TRIPS**

1. 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 results of his scientific research work.
2. Ass. prof. Shirmail Bagirov was on a professional trips in Moscow and gave a talk in Moscow State University on the obtained results of his scientific research work.

**In 2016, collaborators of the department published 13 papers, 1 textbook, 8 abstracts, 12 papers are represented for publication.**

**Head of department:**

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



