

Report of “Differential Equations” Department on scientific and social activities for 2021

The department consists of 15 collaborators. There are 13 scientific workers, including 8 doctors of sciences and 4 philosophy doctors. The department conducts 10 research studies on one subject according to the plan in 2021.

Executed scientific works

Work 1. The mixed problem with nonlinear dissipative boundary condition for nonlinear hyperbolic system that has a variable growth order. **Executer: d.ph.m.s., prof. A.B.Aliev.**

1. **A. B. Aliev**, and G. Kh. Shafieva, Blow-up of Solutions of a Mixed Problem for Systems of Wave Equations with Boundary Dissipation and with an Interior Nonlinear Focusing Source of Variable Growth Order, *Differential Equations*, 2021, Vol. 57, No. 3, pp. 291–303. ©Pleiades Publishing, Ltd., 2021. Russian Text ©The Author(s), 2021, published in *Differentsial'nye Uravneniya*, 2021, Vol. 57, No. 3, pp. 313–325.

2. **Aliev A.B.**, Shafieva G.K. Mixed problem with dynamical transmission condition for a one-dimensional hyperbolic equation with strong dissipation. *Math Meth Appl Sci.* 2021;1–13. Volume 44, Issue 8, 30 May 2021, Pages 7121-7133

<https://onlinelibrary.wiley.com/doi/10.1002/mma.7248>

3. **A. B. Aliyev** and G. R. Gadirova, The well-posedness of the mixed problem for one system of thermoelasticity with singular coefficient, *Proceedings of the Institute of Mathematics and Mechanics, National Academy of Sciences of Azerbaijan (online)*

Тезисы:

1. **А.Б. Алиев**, Г.Х. Шафиева Разрушение решений смешанной задачи для волновых уравнений с граничной нелинейной диссипацией и внутренним нелинейным фокусирующим источником переменного порядка роста, *Актуальные проблемы математики и информационных Технологий. Материалы II Всероссийской конференции с международным участием (г. Махачкала, 5-7 февраля 2021 г., стр. 20 – 22.*

2. **A. B. Aliev**, and G. Kh. Shafieva “Blow-up Solutions of Mixed Problem for a Nonlinear One-dimensional Wave Equation with Variable-exponent Nonlinearities, Dynamical Transmission Condition and Boundary Damping”, “4th International Conference on Mathematical Advances and Applications”, 26-29 May 2021, Istanbul.

3. **Алиев А.Б.**, Исаева С.Э., Существование минимального глобального аттрактора для начально-краевой задачи с акустическими условиями сопряжения для нелинейных волновых уравнений с дефокусирующими источниками и запаздывающими диссипациями, *Azərbaycan xalqının Ümummilli lideri Heydər Əliyevin anadan olmasının 98*

– ci ildönümünə həsr olunmuş “Riyaziyyat, Mexanika və onların tətbiqləri” adlı Respublika elmi konfransının materialları, Bakı, 24-25 May, 2021, 123-125.

4. **А.Б. Алиев**, Г.Х. Шафиева, Смешанная задача для систем волновых уравнений с граничной диссипацией и внутренним нелинейным фокусирующим источником переменного порядка роста, Фундаментальные и прикладные проблемы математики и информатики, Материалы Международной конференции приуроченной к 90 летию Дагестанского Университета 6- 19 сентября 2021 г., стр.20-22.

Work 2: The problem with spectral parameter at the boundary for the fourth order differential operator equation. **Executors: prof. M.Bayramoglu, d.m.sc., prof. N.M.Aslanova.**

1. Fatma Aydın Akgün, M.Bayramoğlu “On regularized trace of differential operator with bounded operator coefficient on finite segment” Turkish Journal of Mathematics

2. M.Bayramoğlu, İ.Ş.Cabbarov, L.Q.İsmaylova “Çoxobrazlının ekstrimallığı ilə onun bir neçə ekzemplarının topoloji hasilinin affin obrazının ekstremalları arasında əlaqə haqqında” AMEA RMI-nin Xəbərləri

3. **N.M.Aslanova**, X.M.Aslanov On Selfadjoint Extensions Of Symmetric Operator With Exit To Larger Space, TWMS Journal of Pure and Applied Mathematics.

Work 3: The qualitative properties of solutions of nonlinear elliptic equations in non-smooth domains. Executor **d.ph.m.s., prof. T.S.Gadjiev.**

In 2021, work is proceeding according to plan:

1. T.Gadjiev. Nonlinear elliptic equations with small BMO coefficients in nonsmooth domains in generalized Morrey spaces- JMI, 2021, V.15, N=2. June 2021 WOS, IF. 1.256

2. T.Gadjiev. Forcing the system by a drift-Math.stud. 55(2021), 201-205 SCOPUS

3. T.Gadjiev. The regularity of solutions higher order nondivergence elliptic equations with VMO coefficients in Orlicz-Morrey spaces- ICMSEM 2021, SPRINGER, Vol 1, Chapter 35, AISC 1396 WOS

4. T.Gadjiev. The uniformly parabolic equations of higher order with discontinuous data in generalized Morrey spaces and elliptic equations in unbounded domains- Book. Advances in the solution of Nonlinear differential equations, 2021, doi: 10.5772/intechopen.96781, Edited by Bruno Carpentieri WOS

5. T.Gadjiev. A MATHEMATICAL MODEL FOR THE FORMATION OF THE MINERAL COMPOSITION OF ROCKS REMOVED TO THE SURFACE DURING A VOLCANO ERUPTION.-GEOMATE CONGRES, 2021, KIOTO-, JAPAN, 3-5 NOVEMBER

Work 4: Structural properties of solutions of linear and nonlinear boundary value problems for some differential equations with definite and indefinite weights. **Executors: prof. Z.S.Aliyev, d.ph.m. H.Rzayeva**

The results are reflected in the following published articles and theses:

1. Z.S. Aliyev, N.A. Neymatov, H.Sh. Rzayeva, Unilateral global bifurcation from infinity in nonlinearizable one dimensional Dirac problems, **International Journal of Bifurcation and Chaos** (Journal Citation Reports®, Clarivate Analytics; IF 2.836; Q1) **31**(1) (2021), 1-10.
2. Z.S. Aliyev and X.A. Asadov, Global bifurcation from zero in some fourth order nonlinear eigenvalue problems, **Bulletin of the Malaysian Mathematical Sciences Society** (Journal Citation Reports®, Clarivate Analytics; IF 1.554; Q2) **44**(2) (2021), 981-992.
3. Z.S. Aliyev, Y.T. Mehraliyev, E.H. Yusifova, On some nonlocal inverse boundary problem for partial differential equations of third order, **Turkish Journal of Mathematics** (Journal Citation Reports®, Clarivate Analytics; IF 0.803; Q2) **45**(4) (2021), 1871-1886.
4. Z.S. Aliyev, Ya.T. Mehraliyev, E.H. Yusifova, Inverse boundary value problem for a third-order partial differential equation with integral conditions, **Bulletin of the Iranian Mathematical Society** (Journal Citation Reports®, Clarivate Analytics; IF 0.644; Q3) **47**(6) (2021), 1641-1660.
5. Z.S. Aliyev, L.V. Nasirova, Bifurcation from zero or infinity in nonlinearizable Sturm–Liouville problems with indefinite weight, **Electronic Journal of Qualitative Theory of Differential Equations** (Journal Citation Reports®, Clarivate Analytics; IF 1.874; Q2) (2021), no. 55, 1–16.
6. Z.S. Aliyev, K.F. Abdullayeva, Uniform convergence of spectral expansions in the terms of root functions of a spectral problem for the equation of a vibrating beam, **Journal of Mathematical Study** (Journal Citation Reports®, Clarivate Analytics) **54**(4) (2021), 435-450.
7. З.С. Алиев, М.М. Мамедова, О глобальной бифуркации одной полулинеаризируемой задачи на собственные значения, Вестник Бакинского Университета. Серия физико-математических наук, (2021), № 1, 29-37

Abstracts:

1. З.С. Алиев, Я.Т. Мехралиев, Э.Г. Юсифова, Об одной обратной краевой задаче для уравнения с частными производными третьего порядка с интегральными условиями, Материалы международной конференции Воронежской зимней математической школы «Современные проблемы теории функций и смежные проблемы», Воронеж, Россия, 28 января-02 февраля 2021г., с. 33-34.
2. З.С. Алиев, К.Ф. Абдуллаева, О равномерной сходимости разложений по собственным функциям дифференциального оператора четвертого порядка со спектральным параметром в граничном условии, Материалы международной конференции Воронежской зимней математической школы «Современные проблемы теории функций и смежные проблемы», Воронеж, Россия, 28 января-02 февраля 2021г., с. 34-35.
3. З.С. Алиев, В.А. Мехрабов В.А. Некоторые спектральные свойства одной краевой задачи на собственные значения со спектральным параметром в трех граничных условиях, Материалы Международной конференции «Некоторые актуальные проблемы современной математики и математического образования. Герценовские чтения-2021», Россия, Санкт-Петербург, 05-10 апреля 2021г., с. 21-23.
4. Z.S. Aliyev, V.A. Mehrabov, On the spectral problem for ordinary differential equations of fourth order with spectral parameter contained in three of the boundary conditions, Abstract book of 8th International conference on recent advances in pure and applied mathematics (ICRAPAM 2021), Bodrum/Mugla, Turkey, September 24-27 2021, pp.28-29.
5. З.С. Алиев, М.М. Мамедова, Глобальная бифуркация решений некоторых полулинеаризируемых задач на собственные значения для обыкновенных

дифференциальных уравнений четвертого порядка, Ümummilli Lider Heydər Əliyevin 98-ci ildönümünə həsr olunmuş “Riyaziyyat, Mexanika və Tətbiqləri” mövzusunda Respublika virtual elmi konfransın materialları, 24-25 may 2021-ci il, Bakı, Azərbaycan, s. 125-127.

6. З.С. Алиев, К.Р. Рагимова, О бифуркации решений нелинейной задачи на собственные значения для одного класса квазилинейных эллиптических уравнений в частных производных обыкновенных дифференциальных уравнений четвертого порядка, Ümummilli Lider Heydər Əliyevin 98-ci ildönümünə həsr olunmuş “Riyaziyyat, Mexanika və Tətbiqləri” mövzusunda Respublika virtual elmi konfransın materialları, 24-25 may 2021-ci il, Bakı, Azərbaycan, s. 127-128

Accepted for publication:

1. Z.S. Aliyev, G.T. Mamedova, Spectral properties of a beam equation with eigenvalue parameter occurring linearly in the boundary conditions, Proceedings of the Royal Society of Edinburgh Section A: Mathematics (Journal Citation Reports®, Clarivate Analytics; IF 1.319; Q1) (2021), pp.1-22;
<https://doi.org/10.1017/prm.2021.34>

Work 5: Investigation of the solution of some boundary value problems for the second-order elliptic differential-operator equation with quadratic complex parameters. **Executors: d.m.s., prof. B.A.Aliyev, d.ph.m.s., prof. N.M.Suleymanov.**

1. **Bahram A. Aliev**, Vugar Z. Kerimov. On solvability of a boundary value problem for a second order elliptic differential-operator equations with a complex linear parameter. Transactions National Academy of Science Azerbaijan Series of physical-technical & mathematics science, 41(4), 17-30 (2021).

2. **Bahram A. Aliev**, Vugar Z. Kerimov and Yakov S. Yakubov. Solvability of a boundary value problem for a second order elliptic differential-operator equation with a complex parameter. Proceedings of the Institute of Mathematics and Mechanics, NAS of Azerbaijan.

3. **Б.А.Алиев**, В.З.Керимов. О собственных значениях одной краевой задачи для эллиптического дифференциально-операторного уравнения второго порядка со спектральным параметром в условиях сопряжения. Актуальные проблемы математики и информационных Технологии. Материалы II Всероссийской конференции с международным участием (г.Махачкала, 5-7 февраля 2021 г., стр. 23-25)

Work 6: Applications of one-dimensional Schrödinger operator with exponential potential in the theory of Bessel functions. **Executor: d.ph.m.s., prof. Agil Kh.Khanmamedov.**

1. **A.Kh. Khanmammadov**. THE ZEROS OF MODIFIED BESSEL FUNCTIONS AS FUNCTIONS OF THEIR ORDER// Trans. Natl. Acad. Sci. Azerb. Ser. Phys.-Tech. Math. Sci. Mathematics, 41 (1), 133-137 (2021).

2. **A.Kh. Khanmammadov** A NOTE ON THE SCHRODINGER OPERATOR WITH EXPONENTIAL POTENTIAL // Proceedings of the Institute of Mathematics and Mechanics, National Academy of Sciences of Azerbaijan Volume 47, Number 1, 2021, Pages 138–142

<https://doi.org/10.30546/2409-4994.47.1.138>

3. **A.Kh. Khanmammadov**. On zeros of the modified Bessel function of the first kind// Azerbaijan Journal of Mathematics vol 11, no 2 (2021), pp.176-182.

4. **A.Kh. Khanmammadov**. Special solutions of the Stark equation// Advanced Mathematical Models & Applications, 2021, V.6, No.1, pp.59-62.

5. **A.Kh. Khanmammadov** . One remark on the inverse scattering problem for the perturbed Stark operator on the semiaxis// Georgian Math. J. 2021; ???(???): 1–4.

Work 7: Investigation of elliptic-parabolic operators in generalized anisotropic Morrey spaces. **Executor:** d.ph.m. , ass.prof. Sh.A.Muradova.

1. **Shemsiyye A. Muradova**. On boundedness of anisotropic singular operator in anisotropic generalized Morrey spaces. Актуальные проблемы математики и информационных Технологий. Материалы II Всероссийской конференции с международным участием (г. Махачкала, 5-7 февраля 2021 г., стр. 116-118) (РИНЦ-2021).

2. **Ş.Ə. Muradova, L.Ş. Əlizadə**. Ümumiləşmiş Morri fəzalarında kompleks Riss çevirməsinin məhdudluğu AZƏRBAYCAN XALQININ ÜMUMMİLLİ LİDERİ HEYDƏR ƏLİYEVİN ANADAN OLMASININ 98-Cİ İLDÖNÜMÜNƏ HƏSR OLUNMUŞ «RİYAZİYYAT, MEXANİKA VƏ ONLARIN TƏTBİQLƏRİ» adlı RESPUBLİKA ELMİ KONFRANSININ MATERİALLARI, BAKI, 24-25 may, 2021, s. 65-67.

3. E.M. Mustafayev, **Sh.A. Muradova**. Investigation of one three-dimensional biharmonic operator. ФУНДАМЕНТАЛЬНЫЕ И ПРИКЛАДНЫЕ ПРОБЛЕМЫ МАТЕМАТИКИ И ИНФОРМАТИКИ, Материалы XIV Международной конференции, приуроченной к 90-летию Дагестанского Государственного Университета, 16–19 сентября 2021 г., стр. 168-169.

Work 8: The study of multidimensional mixed problem for one class of third order differential equations with nonlinear operator on the right-hand side. **Executor:** d.ph.m. ass.prof. A.G.Aliyeva.

The article reflecting the obtained results were accepted for publication:

1. S.Aliyev, **A.Aliyeva**. The investigation of correctness of multidimensional mixed problem for one class of third order non-linear differential equations, Austrian Journal of Technical and Natural Sciences, №1-2, 2021, p.20-23.

2. С.Дж.Алиев, **А.Г.Алиева**, Исследование многомерной смешанной задачи для одного класса нелинейных дифференциальных уравнений третьего порядка, BDU-nun xəbərləri, fizika-riyaziyyat elmləri seriyası, №1, 2021, s.5-14.

Work 9: Solvability of the Dirichlet problem for harmonic functions with the boundary values from grand Hardy classes. **Executor:** d.ph.m. N.R.Ahmedzade.

1. **Nigar Ahmedzade, Zaur Kasumov**. On the solvability of the Dirichlet problem for the Laplace equation with the boundary value in grand-Lebesgue space. Nakhchivan State

University. Scientific works. The series of Physical, mathematical and technical sciences.2020 №5 (106), pp 62-69.

Works accepted for publication:

1. Bilal T. Bilalov, Nigar R. Ahmedzadeh, Tarlan Z. Garayev, Some remarks on solvability of Dirichlet problem for Laplace equation in non-standard function spaces. Mediterranean J. of Mathematics

Works prepared for printing:

2. Z.A. Kasumov & N.R. Ahmedzade. О некоторых свойствах потенциала Рисса в пространствах гранд Лебега и гранд-Соболева

Abstracts:

1. Z.A. Kasumov & **N.R. Ahmedzade**. On Some Properties of the Riesz Potential in Grand-Lebesgue and Grand-Sobolev Spaces. **4th** International Conference on Mathematical Advances and Applications (ICOMAA-2020), 26-29 May, 2021, Turkey, p. 217

2. **Nigar Ahmedzadeh** and Tarlan Garayev. Some Remarks on Solvability of Dirichlet Problem for Laplace Equation in Non-standard Function Spaces. **4th** International Conference on Mathematical Advances and Applications (ICOMAA-2020), 26-29 May, 2021, Turkey, p. 162

Work 10: Mathematical analysis of the oscillations of suspension bridge in the case when the tensioning cable has one common point with the roadbed. **Executors: d.ph.m.s., prof. A.B.Aliev, Y.M.Ferhadova**

1. A.B. Aliev, Y.M. Farhadova, Existence of Global Attractors for the Coupled System of Suspension Bridge Equations wen Common point with the Roadbed, Azerbaijan Journal of Mathematics, Vol. 11, N 2 (2021), p.105-124.

2. Y.M. Farhadova, Existence of Solution of Nonlinear Bridge Problem with Time-delay in Aerodynamic Resistance Force, Journal of Contemporary Applied Mathematics, V. 11, No 2, 2021, December

Abstracts:

А.Б. Алиев, Е.М. Фархадова, Нелинейная задача подвешенного моста с запаздыванием силы аэродинамического сопротивления, Фундаментальные и прикладные проблемы математики и информатики, Материалы Международной конференции приуроченной к 90 летию Дагестанского Университета 6- 19 сентября 2021 г.стр.18-20.

Scientific works published by dissertators and doctoral students of the department

G. Kh. Shafiyeva, Asymptotic behaviour of solutions of mixed problem for linear thermoelastic systems with microtemperatures and microstretch, Trans. Natl. Acad. Sci. Azerb. Ser. Phys.-Tech.Math.Sci.Mathematics,41(4),131-140(2021).

Hüseynova R.İ., Mikrotemperaturun nəzərə alınması şərti daxilində istilik elastikiyyət nəzəriyyəsi üçün başlanğıc sərhəd məsələsi, Azərbaycan Respublikası Təhsil Nazirliyi, Sumqayıt Dövlət Universiteti, Magistrantların XXI Respublika Elmi konfransı, 17-18 may 2021-ci il, s. 44-45

SOCIAL ACTIVITY OF COLLABORATORS OF THE “DIFFERENTIAL EQUATIONS” DEPARTMENT

All collaborators have been actively participated (before the pandemic) in the Institute's general works, including the Institute Seminar.

Before the pandemic, every Wednesday, at 12.00, the scientific seminar named “Modern problems of the theory of differential equations” guided by A.B.Aliev, had being conducted. All collaborators of department, including doctoral and post-graduate students participated in the seminar.

Akper Aliev is the member of the Expert Commission under the HAC. He is also a member of the "Scientific Council on Mathematical Problems" under the "Coordinating Council of Republican Scientific Research."

The collaboratos of the department, prof. Akper Aliev, prof. Mammad Bayramogly, prof. Ziyatkhan Aliyev, prof. Tahir Gadjiev, prof. Agil Khanmamedov, prof. Bakhran Aliev, ass.prof. Nigar Aslanova, ass.prof. Shamsiya Muradova teaches at the universities of the Republic (Azerbaijan Technical University, BSU, ASPU, AACU) for bachelors and masters.

There are scientific relations with some scientific centers and educational institutions of the country.

At the international level, there are contacts with the following scientific educational institutions

- **Moscow State University (prof. A.V.Furskov, prof. L.Krichkov);**
- **Dagestan State University**
- **Tbilisi State University and Razmadze Institute of Mathematics;**
- **Some Universities in Turkey (Hacattepe University, Sivas University, Tokat University, Koç University, Kütahya University);**
- **Frans. Prof. Mokhtar Kirane**(Mathematician, Professor at University of La Rochelle, Fransa, **Khalifa University, United Arab Emirates);**
- **İsrael, Tel- Aviv , Tel- Aviv University, prof. Yakov Yakubov;**
- **-Almaniya , prof. Efendiyev M.** Institute of Computational Biology Helmholtz Zentrum Muchen, 85764 Neuherberg, Germany
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The collaborator of the department, **d.ph.m. N.R.Ahmedzade** is the executor of the project "Methods of spectral theory and non-harmonic Fourier analysis in some issues of classical and

quantum mechanics" of the Science Development Foundation under the President of the Republic of Azerbaijan(2021/2022)

Total – 28+18=46 work

Article - 28 (published, prepared and submitted for publication)

Thesis – 18.

Head of Department

prof. Akbar B. Aliev