

**Report on the scientific and scientific-organizational activities of the department
"Differential Equations" for the first half of 2022**

The Department of Differential Equations has 12 employees. Of which 10 scientists, 6 doctors of science and 4 doctors of philosophy. In accordance with the work plan for 2022, the department is conducting 9 research works on one topic.

TOPIC: Some Problems in the Theory of Partial Differential Operators”.

Work 1. Existence of a local solution of a mixed problem with a nonlinear boundary condition for nonlinear hyperbolic equations with variable growth and their finite time distribution. **Executer: d.ph.m.s., prof. A.B.Aliev.**

Published works:

1. **A.B. Aliev**, G.A. Aliyev, A.N. Huseynova, A Mixed Problem For A One-Dimensional Viscoelasticity Equation With Non-Stationary Conjugation Conditions, Baku Mathematical Journal, 2022, Vol.1, pp. 63-77.

<https://doi.org/10.32010/j.bmj.2022.07>

2. **А.Б.Алиев**, Г.И.Юсифова. Смешанная задача для систем нелинейных гиперболических уравнений с анизотропной эллиптической частью и нелинейной диссипацией. **Актуальные проблемы математики и информационных технологий.** Материалы III Всероссийской конференции (г. Махачкала, 7-9 февраля 2022 г.). – Махачкала: Издательство ДГУ, 17.

3. **A.B. Aliev**, G.Kh. Shafieva. Initial-boundary value problem for systems of wave equations with nonlinear boundary dissipation and with a nonstandard interior nonlinear source. **International Conference “Modern Problems of Mathematics and Mechanics” dedicated to the 110-th anniversary of the academician Ibrahim Ibrahimov, Baku, 29 June-01 July, 2022, p. 42.**

Works accepted for publication:

1. **A.B. Aliev**, G.Kh. Shafieva, Blow-up of solutions of a mixed problem for wave equations with a nonlinear conjugation condition and an internal focusing source of variable order of growth, XII International Conference of the Georgian Mathematical Union, Batumi

2. **A.B. Aliev**, G.Kh. Shafieva, Смешанная задача для систем гиперболических уравнений с граничной диссипацией и внутренним нелинейным фокусирующим источником переменного порядка роста, Дифференциальные уравнения.

3. **A.B. Aliev**, G.Kh. Shafieva, Blow - up of solutions of wave equation with a nonlinear boundary condition and interior focusing source of variable order of growth. Math. Meth. Appl. Science, AUTHOREA:

<https://www.authorea.com/users/356799/articles/572345-blow-up-of-solutions-of-wave-equation-with-a-nonlinear-boundary-condition-and-interior-focusing-source-of-variable-order-of-growth>

Work 2: Regularity of Solutions to Parabolic Equations with Separated Coefficients.
Executor: d.ph.m.s., prof. T.S.Gadjiev.

1. **T.S.Gadjiev.** Transactions of A.Razmadze Mathematical Institute, v.175, issue 3, pp.345-353.

Work 3: Investigation of linear and nonlinear eigenvalue problems for second and fourth order ordinary differential operators. **Executors: prof. Z.S.Aliyev, d.ph.m. H.Rzayeva.**

The results obtained are reflected in the following published works:

1. **Z.S. Aliyev,** G.T. Mamedova, Spectral properties of a beam equation with eigenvalue parameter entering via linearly to the boundary conditions, Proceedings of the Royal Society of Edinburgh Section A: Mathematics (**IF-1.25; Q1**), v. 152, no. 3, p. 780–801.

2. **З.С. Алиев,** М.Г. Панахов, О бифуркации из бесконечности в некоторых нелинейных задачах на собственные значения для пары операторов, Azərbaycan Xalqının Ümummilli Lideri Heydər Əliyevin anadan olmasının 99-cu ildönümünə həsr olunmuş "Riyaziyyat və mexanikanın aktual problemləri" Respublika elmi konfransının materialları, Bakı Dövlət Universiteti, 11-13 may 2022-ci il, Bakı s. 245–246.

Works accepted for publication:

1. **Z.S. Aliyev,** Y.N. Aliyeva, Global bifurcation results for some fourth-order nonlinear eigenvalue problem with a spectral parameter in the boundary condition, Mathematical Methods in the Applied Sciences, 2022.

2. **Z.S. Aliyev,** N.A. Ismayilova, Global bifurcation from zero in nonlinear Sturm-Liouville equation with a spectral parameter in the boundary condition, Quaestiones Mathematicae, 2022.

Work 4: Solution of a boundary value problem with an operator boundary condition for a second-order elliptic operator-differential equation with a complex parameter. **Executors: d.m.s., prof. B.A.Aliyev, d.ph.m.s., prof. N.M.Suleymanov.**

1. **Б.А.Алиев,** С.З.Халыгова. “Вопросы разрешимости одной краевой задачи для эллиптических дифференциально-операторных уравнений второго порядка с комплексным параметром. Аналитические и численные методы моделирования естественно-научных и социальных проблем: сб. ст. по материалам XVIII Междунар. науч.-техн. конф. (г. Пенза, Россия, 1-4 декабря 2021 г.) стр. 42-45

2. **Б. А.Алиев.** Разрешимость одной краевой задачи с операторными граничными условиями для эллиптического дифференциально-операторного уравнения второго порядка с комплексным параметром. АКТУАЛЬНЫЕ ПРОБЛЕМЫ МАТЕМАТИКИ И ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ Материалы III Всероссийской конференции с международным участием, г. Махачкала, 7-9 февраля 2022 г., сс.12-16.

3. B.A.Aliev. On solvability of one boundary value problem for a second order elliptic differential-operator equation containing a complex parameter. International Conference “Modern Problems of Mathematics and Mechanics” dedicated to the 110-th anniversary of the academician Ibrahim Ibrahimov, Baku, 29 June-01 July, 2022, **p. 33.**

Work 5: Direct and inverse problems of spectral analysis for the one-dimensional Schrödinger equation with an additive potential. **Executor: d.ph.m.s., prof. Agil Kh.Khanmamedov.**

The results obtained are published in the following 4 papers:

- 1. A. Kh. Khanmamedov.** One remark on the transformation operator for perturbed Hill operators// Azerbaijan Journal of Mathematics V. 12, No 1, 2022, January, pp.160-166.
- 2. A. Kh. Khanmamedov.** The Riemann function of the Cauchy problem for a second-order hyperbolic equation with a periodic coefficient// Advanced Mathematical Models & Applications, 2022, v.7, №1,pp. 44-47.
- 3. A. Kh. Khanmamedov.** To the inverse spectral problem for a perturbed oscillator on the semiaxis// Proceedings of the Institute of Mathematics and Mechanics of NAS of Azerbaijan, 2022, V. 48, №1, 12-21.
- 4. A. Kh. Khanmamedov.** The Jost solutions to the Schrodinger equation with an additional complex potential// Trans. Natl. Acad. Sci. Azerb. Ser. Phys.-Tech. Math. Sci. Mathematics, 42 (1), 1-5 (2022).

Work 6: Gradient estimates for elliptic-parabolic operators in generalized weighted Morrey spaces. **Executor: d.ph.m. , ass.prof. Sh.A.Muradova.**

- 1. Ш.А. Мурадова, Э.М. Мустафаев.** Об одной задаче рассеяния с сингулярным потенциалом типа меры. АКТУАЛЬНЫЕ ПРОБЛЕМЫ МАТЕМАТИКИ И ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ Материалы III Всероссийской конференции с международным участием, г. Махачкала, 7-9 февраля 2022 г., сс.135-138.
- 2. Sh. A. Muradova.** Boundedness of anisotropic singular operator in anisotropic generalized Morrey spaces. **International Conference “Modern Problems of Mathematics and Mechanics” dedicated to the 110-th anniversary of the academician Ibrahim Ibrahimov, Baku, 29 June-01 July, 2022, p. 154.**
- 3. E.M. Mustafayev, Sh.A. Muradova.** On a dispersion problem with a singular potential of measure type. **International Conference “Modern Problems of Mathematics and Mechanics” dedicated to the 110-th anniversary of the academician Ibrahim Ibrahimov, Baku, 29 June-01 July, 2022, p. 158.**

Work 7: Study of a Multidimensional Mixed System of Problems for a Class of Nonlinear Third Order Differential Equations. **Executor: d.ph.m. ass.prof. A.G.Aliyeva.**

The results obtained are published in the following works:

1. S.Aliyev, **A.Aliyeva**; Some a priori estimates for solutions of a multidimensional mixed problem for a class of nonlinear differential equations of the third order, *The European Journal of Technical and Natural Sciences*, № 1-2, p.12-16.

2. S.Aliyev, **A.Aliyeva**. The investigation of multidimensional mixed problem for one class of third Order semilinear pseudohyperbolic equations, 5th International online conference on Mathematical Advances and Applications, May, 11-14, 2022, Yıldız Technical University, İstanbul, Türkiye.

Work 8: On various formulations of the Dirichlet problem for the Laplace equation in non-standard function spaces. **Executor: d.ph.m., N.R.Ahmedzade.**

Published works:

1. Bilalov, B.T., **Ahmedzadeh, N.R.**, Garayev, T.Z. Some Remarks on Solvability of Dirichlet Problem for Laplace Equation in Non-standard Function Spaces. *Mediterr. J. Math.* **19**, 133 (2022).

<https://doi.org/10.1007/s00009-022-02045-y>

Works accepted for publication:

1. Z.A. Kasumov, **N.R. Ahmedzade**. О некоторых свойствах потенциала Рисса в пространствах гранд Лебега и гранд-Соболева. Труды Московского математического общества".

2. Z.A. Kasumov, **N.R. Ahmedzade**. On some properties of the Riesz potential in the grand Lebesgue and grand Sobolev spaces. The XII International Conference of the Georgian Mathematical Union.

3. Z.A. Kasumov, **N.R. Ahmedzade**. On some properties of the Riesz potential in the grand Lebesgue and grand Sobolev spaces. *Modern problems of Mathematics and Mechanics*.

Work 9. Problems of the exponential decrease in the energy of a suspension bridge in the presence of linear aerodynamic forces with delay. **Executors: d.ph.m.s., prof. A.B.Aliev, Y.M.Ferhadova.**

1. **А.Б.Алиев, Е. М. Фархадова**. Математический анализ динамических моделей подвесных мостов с запаздывающим демпфированием. **Актуальные проблемы математики и информационных технологий**. Материалы III Всероссийской конференции (г. Махачкала, 7-9 февраля 2022 г.). – Махачкала: Издательство ДГУ, 2022 с.19.

2. **Y.M. Farhadova**. Existence of solution of nonlinear bridge problem with time-varying delay. **International Conference “Modern Problems of Mathematics and Mechanics” dedicated to the 110-th anniversary of the academician Ibrahim Ibrahimov, Baku, 29 June-01 July, 2022**, p. 78.

Works accepted for publication:

1. **Y.M. Farhadova**, Existence of solution of nonlinear bridge problem with time-varying delay.
2. **A.B. Aliyev, Y. M. Farhadova**, Existence and exponential stability of solution of nonlinear bridge problem with time delay damping.

Social Activity Of Collaborators Of The “Differential Equations” Department

Every Wednesday at 12.00 the department holds a seminar "*Modern problems in the theory of differential equations*" under the guidance of prof. A.B. Aliyev. All employees of the department, including doctoral students, dissertators and masters take part in these seminars. During this period, several scientific papers and dissertations were discussed in the department..

The employees of Department prof. Akbar Aliyev, prof. Ziyatkhan Aliyev, prof. Agil Khanmamedov, prof. Tahir Hajiyev, prof. Bahram Aliyev, assoc.prof. Shemsiyye Muradova teaches at the universities of the republic (Azerbaijan Technical University, BSU, ADPU, AZMU) for bachelors and masters.

Head of department prof. Akbar Aliyev made a plenary report on the topic: "Existence and absence of global solutions of nonlinear hyperbolic equations in function spaces of variable degree" at the International Scientific Conference "Actual Problems of Physics, Astronomy and Mathematics" at Nakhichevan State University.

Head of department prof. Akbar Aliyev made a plenary report on the topic: "Global existence and nonexistence of solutions for a system of nonlinear hyperbolic equations with damping", at the republican conference held at BSU and dedicated to the 99th anniversary of the national leader of Azerbaijan Heydar Aliyev, may 11-13, 2022.

Senior Researcher of the Department, Ph.D. N. Ahmadzade successfully completed the project "Methods of Spectral Theory and Nonharmonic Fourier Analysis in Some Issues of Classical and Quantum Mechanics" of the Foundation for the Development of Science under the President of the Republic of Azerbaijan in March of this year, of which she was a co-participant (2021/2022).

Total – 19+17=36 work:

Article - 9 published, 10 prepared and submitted for publication

Thesis – 17

Head of Department

prof. Akbar B. Aliyev