REPORT

of the "Differential Equations" Department on the scientific and social activities for the 2025

Executed scientific works

The "Differential Equations" department consists of 11 employees, including 5 Doctors of Science, 3 PhDs, and a total of 10 scientific staff. In accordance with the 2025 plan, the department is conducting research on a single topic involving 8 scientific research projects.

Work № 1. Investigation of One-Dimensional Mixed Problems with Time Delay in Boundary Conditions for Second-Order Linear Parabolic Equations. **Executor:** Head of Department, Academician Yusif Mammadov.

1. **Y. Mammedov**, H.I. Ahmedov, Existence and uniqueness of the solution of a mixed problem for a parabolic equation under nonconventional boundary conditions. 2411.16109, vol.1 (Math. Ap.), 19 November 2024, pp.1-19
2. **Ю. Маммедов**, Х. И. Ахмедов, Об одной смешанной задаче для уравнения параболического типа с постоянными коэффициентами. Доложена в 7й Международной Конференции «Динамические системы компьютерные науки» (DYSC 2025) принята на публикацию в полном объеме в журнале «Итоги науки и техники, серия Современна математика и ее приложения», 2025 (in print).
3. **Y. Mammedov**, H.I. Ahmedov, Solution of mixed problem for the parabolic type equation with time advance in boundary conditions on rectangular plate. Communicational Therretical Physics (China) (accepted).
4. **Y. Mammedov**, V.Y. Mastaliyev, On Existense and Uniqueness of a the solution to a mixed problem for a class of non-classical equations. FILOMAT 39:19 (2025), pp.6651-6664
   https://journal.pmf.ni.ac.rs/filomat/index.php/filomat/article/view/25636.

Work 2: Investigation of Solutions of Parabolic Equations in Non-Smooth Domains. **Executor:** d.ph.m.s., prof. T.S.Gadjiev**.**

1. Rustamov, Y., **Tahir Gadjiev**, Akhundova, S., Khudiyeva, A., Determination of Soil Fertility in the Study Area According to Agrochemical Parameters. - International Conference on Management Science and Engineering Management (ICMSEM 2025). Lecture Notes on Data Engineering and Communications Technologies, vol 264. Springer, Singapore, pp 403–414, Scopus
   https://link.springer.com/chapter/10.1007/978-981-95-1595-0_29
2. **Tahir Gadjiev**, The a priori estimates and regularity of solutions the nonlinear parabolic equations in generalized Morrey spaces. - European Journal of Mathematics, 2025, çapdadır, IF, Q2
3. Rustamov, Y., **Tahir Gadjiev**, Aliyev, S.Y., Hajiyev, Z.T. The Behaviour of Solutions Boundary Problem to Nonlinear Elliptic Equations. -International Conference on Management Science and Engineering Management International Conference on Management Science and Engineering Management (ICMSEM 2025). Lecture Notes on Data Engineering and Communications Technologies, vol 264. Springer, Singapore, pp 481–492, Scopus
   https://link.springer.com/chapter/10.1007/978-981-95-1595-0_35
4. **Tahir Gadjiev**, The Behaviour of Solutions Boundary Problem to Nonlinear parabolic equations. 7th International Conference on Applied Physics, Simulation and Computing, Amalfi Coast - Salerno, Italy, June 20-23, 2025 - APSAC 2025 – Amalfi Coast, Italy, p. 66
5. **Tahir Gadjiev**; Sardar Yahya Aliyev; Konul N. Yasinli. The behaviour of solutions boundary problem to nonlinear elliptic equations. -Computational methods for differential

equations, 2025, pp. 1-9, Scopus
doi: 10.22034/cmde.2024.61634.2678

6. **Gadjiev T.S.,** Yagnaliyeva A., Maharramova T., Mamedova K., The a priori estimates and regularity of solutions the nonlinear parabolic equations in generalized Morrey spaces, XL International Conference PROBLEMS OF DECISION MAKING UNDER UNCERTAINTIES (PDMU-2025) September 30 – October 1, 2025, p.60, Poland

7. Hajiyev Z.T., **Gadjiev T.S.** Intelligent Anomaly detection for cybersecurity: real- time simulation and unsupervised deep learning, PDMU 2025. p.64, Poland

8. **Tahir S. Gadjiev**, Terlan A. Maharramova, Some estimates for degenerates' elliptic equations of the second order, Tran. Natl. Acad. Sci. Azerb. Ser. Phys.-Tech. Math. Sci. Mechanics, 45 (7), 3–6 (2025);
https://doi.org/10.30546/2706-7734.45.7.2025.003

Work 3: Investigation of Properties of Eigenfunctions for Linear and Nonlinear Eigenvalue Problems of second and fourth-order Ordinary Differential Equations and Dirac Systems. **Executers: d.ph.m.s., prof. Z.S.Aliyev.**

1. **Z.S. Aliyev**, N.B. Kerimov, V.A. Mehrabov, On convergence of spectral expansions for the equation of a vibrating beam, at one end of which an elastically fixed inertial load is concentrated, Journal of Mathematical Analysis and Applications, 2025, v. 546, No. 2, p. 1–30; WEB of Sciences -- Q_1
https://www.sciencedirect.com/science/article/pii/S0022247X25001301

2. **Z.S. Aliyev**, K.R. Rahimova, Existence of nodal solutions of some nonlinear Sturm-Liouville problems with a parameter in the boundary condition, Azerbaijan Journal of Mathematics, 2025, v. 15, no. 1, p. 243-256;
https://azjm.org/volumes/1501/pdf/1501-16.pdf

3. **Z.S. Aliyev**, T.B. Asadov, Unilateral global bifurcationin some nonlinear eigenvalue problem for elliptic partial diferential equations with indefinite weight, Abstracts of the International scientific conference "Actual problems of algebra, analysis, topology and computational mathematics", 30-31 May, 2025, Tashkent, p. 225-227.

Work 4: Direct and inverse problems of spectral analysis for second-order differential and difference operators and their applications to nonlinear special differential equations. **Executor: d.ph.m.s., prof. Agil Kh. Khanmamedov.**

1. **A. Kh. Khanmamedov, A.F.Mamedova.** Rapidly Decreasing Solution of the Initial Boundary value Problem for an Infinite System of Nonlinear Evolution Equations, Advanced Mathematical Models & Applications, Vol.10, No.1, 2025, pp.81-87 https://doi.org/10.62476/amma.10181

2. **A. Kh. Khanmamedov** On the Inverse Scattering Problem for the Shrodinger Equation with Increasing Potential**,** *Azerbaijan Journal of Mathematics V. 14, No 1, 2025, 105-112,* https://doi.org/10.59849/2218-6816.2025.2.105 Q2.

Work 5: Investigations of the parabolic fractional-integral operator in parabolic local generalized Morrey spaces and its application to partial differential equations. **Executor: d.ph.m. , ass.prof. Sh.A.Muradova.**

1. Muradova Sh.A., "Some conditions for boundedness of parabolic fractional integral operators with rough kernels in parabolic local generalized Morrey spaces and its applications to differential equations". XII International Scientific Conference "Modern Problems of Mathematics and Mechanics", September 03-06, 2025 - Baku/AZERBAIJAN, pp. 104-106.

2. Э.М.Мустафаев, **Ш.А.Мурадова. "**Спектральный анализ одного дифференциального оператора". ФГБОУ ВО «Дагестанский государственный университет» VI ВСЕРОССИЙСКАЯ НАУЧНАЯ КОНФЕРЕНЦИЯ «АКТУАЛЬНЫЕ ПРОБЛЕМЫ МАТЕМАТИКИ И ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ», 21-23 апреля 2025 г., сс. 96-99.

Work 6: The study of a one-dimensional mixed problem for some fourth-order Sobolev-type equations. **Executor: d.ph.m. ass.prof.A.G.Aliyeva.**

1) S.Aliyev, **A.Aliyeva,** S,Aliyev; On A Problem For One Class Of Fourth Order Nonlinear Sobolev Type Differential Equations, Austrian Journal of Technical and Natural Sciences, № 1-2, 2025, 45-48.

2) S.Aliyev, **A.Aliyeva**, Geometric Approaches to Solving Algebraic Inequalities . Erzurum, 17-19 July, Türkiye, 2025, p.19

3) S.Aliyev, **A.Aliyeva**, On The Existence Of Classical Solution To One-Dimensional Fourth Order Non-Linear Differential Equations, Düşənbə, Tacikistan, 28–29 noyabr 2025.

Work 7: Solvability of the Dirichlet problem for Banach-valued harmonic functions. **Executor: d.ph.m. N.R.Ahmedzade.**

1. B.Bilalov, **N.R. Ahmedzade**, Z.A. Kasumov The weighted grand Lebesgue class of harmonic functions and the Dirichlet problem. Lobachevskii Journal of Mathematics, 2025, Vol. 46, No. 1, pp. 377–387.

2. B.Bilalov, **N.R. Ahmedzade,** Z.A. Kasumov. Some Properties of Functions of the Weighted Grand Lebesgue Class hp);ρ. XII International Scientific Conference "Modern Problems of Mathematics and Mechanics", September 03-06, 2025 - Baku/AZERBAIJAN, pp. 65-67.

Work 9. Mathematical analysis of dynamic models of suspension bridges with delayed damping. **Executor: Y.M.Ferhadova.**

1. **Y. Farhadova.** Influence of linear aerodynamic resistance in the absence of external forces on a coupled suspension bridge system. XII International Scientific Conference "Modern Problems of Mathematics and Mechanics", September 03-06, 2025 - Baku/AZERBAIJAN, pp.75-77.

Report of the Aishen Mammadova, doctoral student of the department

1. Abdurrahim F. Guliyev, **Aishen V. Mammadova**, Aydan J. Namatova. On the R-Identity Class of Parabolic Operators of the Second Order. XII International Scientific Conference “Modern problems of Mathematics and Mechanics”, Baku, Azerbaijan, September 03-06, 2025, pp. 81-83.

SOCIAL ACTIVITY OF COLLABORATORS OF THE “DIFFERENTIAL EQUATIONS” DEPARTMENT

The collaboratos of the department, prof. Agil Khanmamedov, prof. Tahir Gadjiev, prof. Ziyatkhan Aliyev, phd Humay Rzayeva, phd, ass.prof. Shamsiya Muradova, junior researcher Aishen Mammadova and junior researcher Yeter Farhadova conduct classes for undergraduate and graduate students at universities in the Republic (BSU, AzUAC, Khazar University, Baku Girls University).

Academician Yusif Mammadov, the head of the department, was a member of the Scientific Committee of the XII International Scientific Conference "Modern Problems of Mathematics and Mechanics," held in Baku, September 3-6, 2025.

Sh. A. Muradova, an employee of the department, was a member of the working group of the XII International Scientific Conference "Modern Problems of Mathematics and Mechanics," held in Baku, September 3-6, 2025.

In 2025, the department’s employees received a total of 130 citations for their scientific works (Yusif Mammadov – 5, Tahir Gadjiev – 33, Ziyatkhan Aliyev – 40, Agil Khanmamedov – 20, Arzu Aliyeva – 23, Shamsiyya Muradova – 2, Nigar Ahmadzade– 7).

Total – 26 work

Article – 12 published and 3 in print

Thesis – 10 published and 1 in print.

Head of Department **Academician Yusif Mammadov**