SEMİ-ANNUAL REPORT

of the "Differential Equations" Department on the scientific and social activities for the 2024

Executed scientific works

In accordance with the work plan for 2024, the department is conducting 9 research studies on one topic.

Topic: "Some problems of the theory of partial differential operators".

Work № 1. Investigation of solutions to a system of hyperbolic equations expressing the bridge problem. **Executers**: **d.ph.m.s., prof. A.B.Aliev; Y.M. Ferhadova.**

1. Y. Ferhadova. "Reduction of the systems of equations describing the dynamics of oscillations of a suspension bridge to the operator equation". XI International Scientific Conference "Modern Problems of Mathematics and Mechanics" July 03-06, 2024 - Baku/AZERBAIJAN, pp.104-106.

Work № 2. Smoothness of solutions of nonlinear elliptic equations in non-smooth domains**. Executor d.ph.m.s., prof. T.S.Gadjiev**.

1. **T.S. Gadjiyev**. A mathematical model for the formation of the mineral composition of rocks removed to the surface a volcano eruption, Journ. Geol. Geograph, Geology, 32(4), 734-740. Web of science EMS
2. **T.S. Gadjiyev**. Mathematical models of mineral waters of Azerbaijan. PLMO 2024, Web of science
3. **T.S. Gadjiyev**. The Behaviour of Solutions the Mixed Boundary Problem to Nonlinear Elliptic Equations in Orlicz-Morrey Spaces. ICMSEM 2024, 23 p. In appear, EI compendex
4. **T.S. Gadjiyev**. The Behaviour of Solutions Boundary Problem to Nonlinear Elliptic Equations, CMDE, 2024, 16 p., (Web of science), (in appear).
5. **T.S. Gadjiyev**. The Behavior of solutions of boundary problem to nonlinear parabolic equations. XI International Scientific Conference "Modern Problems of Mathematics and Mechanics" July 03-06, 2024 - Baku/AZERBAIJAN, 2024, 3 pp.
6. **T.S. Gadjiyev**. The behavior of the solutions of nonlinear parabolic equations. XI International Scientific Conference "Modern Problems of Mathematics and Mechanics" July 03-06, 2024 - Baku/AZERBAIJAN, 3 pp.
7. **T.S. Gadjiyev**. The investigations for determining the temperature on the surface of mineral waters. XI International Scientific Conference "Modern Problems of Mathematics and Mechanics" July 03-06, 2024 - Baku/AZERBAIJAN, 2024, 3 pp.

Work № 3. Investigation of linear and nonlinear eigenvalue problems for second and fourth order ordinary differential operators and one-dimensional Dirac system. **Executers: d.ph.m.s., prof.Z.S.Aliyev, d.ph.m. H.Rzayeva.**

1. **Z.S. Aliyev**, Y.N. Aliyeva, Existence of nodal solutions to some nonlinear boundary value problems for ordinary differential equations of fourth order, Electronic Journal of Qualitative Theory of Differential Equations, 2024, No. 25, 1–13; https://doi.org/10.14232/ejqtde.2024.1.25
2. **Z.S. Əliyev**, Qeyri-xətti Dirak məsələlərinin həllərinin qlobal bifurkasiyası haqqında, Azərbaycan Xalqının Ümummilli Lideri heydər Əliyevin anadan olmasının 101-ci ildönümünə həsr olunmuş "Riyaziyyat, Mexanika və İnformasiya Texnologiyalaının müasir məsələləri" mövzusunda respublika Elmi konfransının materialları, Bakı ş., 02-03 may 2024-cü il, s. 36.
3. **Ziyatkhan S. Aliyev**, Ayna E. Fleydanli, Properties of eigenfunctions of a boundary value problem for ordinary differential equations of fourth-order with boundary conditions depending on the spectral parameter, Journal of Differential Equations, 2024, v. 407, 1-27.
4. **Z.S. Aliyev**, K.R. Rahimova, Nodal solutions of nonlinear Sturm-Liouville problems with a spectral parameter in the boundary condition, Baku State University Journal of Mathematics and Computer Sciences, 2024, v. 1 (2), p. 1-11.
5. **H.Sh. Rzayeva**. Nodal solutions of some nonlinear Dirac systems. XI International Scientific Conference "Modern Problems of Mathematics and Mechanics" July 03-06, 2024 - Baku/AZERBAIJAN, pp. 184-186.

Work № 4. Asymptotic behavior of the eigenvalues of the boundary value problem for the Laplace equation. **Executors:d.m.s., prof. B.A.Aliyev, d.ph.m.s., prof. N.M.Suleymanov.**

The following works were published during the report period.

1. B. A. Aliev, Solvability of a boundary value problem for a secondorder elliptic differential-operator equation with a quadratic complex parameter. XI International Scientific Conference "Modern Problems of Mathematics and Mechanics" July 03-06, 2024 - Baku/AZERBAIJAN, pp. 217-219.

2. N.M. Suleymanov. On an application of Wiman-Valiron type estimate**.** XI International Scientific Conference "Modern Problems of Mathematics and Mechanics" July 03-06, 2024 - Baku/AZERBAIJAN, pp. 196-198.

Work № 5: Spectral analysis of the one-dimensional Schrödinger operator with additional potential. **Executor: d.ph.m.s., prof. Agil Kh. Khanmamedov.**

1. **On the Inverse Spectral Problem for the One-dimensional Stark Operator on the Semiaxis // Azerbaijan Journal of Mathematics V. 14, No 1, 2024, January ISSN 2218-6816 https://doi.org/10.59849/2218-6816.2024.1.122**

2. **Eigenvalue asymptotics of a one-dimensional Schrodinger operator with ¨ confining potential // Trans. Natl. Acad. Sci. Azerb. Ser. Phys.-Tech. Math. Sci. Mathematics, 44 (1), 128-131 (2024). https://doi.org/10.30546/2617-7900.44.1.2024.128**

3. **Transformation operators for the perturbed Hill equation with complex coefficients //Advanced Mathematical Models & Applications Vol.9, No.1, 2024, pp.27-34 https://doi.org/10.62476/amma9127**

4. **On the spectral theory of a fourth-order differential pencil on the whole real axis//Baku Mathematical Journal 2024, Vol. 3, No 1, PP. 58-63 https://doi.org/10.32010/j.bmj.2024.06**

Work № 6. Investigation of the continuity of parabolic fractional-integral operators in parabolic locally generalized Morrey spaces. **Executor: d.ph.m. , ass.prof. Sh.A.Muradova.**

1. **Muradova Sh.A.,** "Boundedness of parabolic fractional integral operator swith rough kernels in parabolic local generalized Morrey spaces". XI International Scientific Conference "Modern Problems of Mathematics and Mechanics" July 03-06, 2024 - Baku/AZERBAIJAN, pp. 171-173.

Work № 7: Classical solution of a one-dimensional mixed problem for one class fourth-order nonlinear differential equations.**Executor: d.ph.m. ass.prof.A.G.Aliyeva.**

1. S.Aliyev, **A.Aliyeva,** M.Heydarova; On the existence of classical solution to one-dimensional fourth order semilinear equations, Advances in Differential Equations and Control Processes,31(2),2024,165-185,(Web of Science, ESCI).

2. S.Aliyev, A.Aliyeva, Using Simmetry in Solving Problems with a Parameter, Modern Problems of Mathematics and Mechanics , 2024.

3. S.Aliyev, A.Aliyeva , Study of onedimensional mixed problem for one class of fourth order nonlinear equations, 7th International Hybrid Conference on Mathematical Advances and Appications, 2024, Yıldız Technical University, İstanbul, Türkiye.

4. S.Aliyev, **A.Aliyeva**, The existence of generalized solution to one dimensional mixed problem for one class of thirth order nonlinear pseudoparabolic equations, International Conference on Modern Problems of Mathematics, Mechanics and their Applications, 2024.

Work № 8: Solvability of the Dirichlet problem in the weighted grand Lebesgue class of harmonic functions.**Executor: d.ph.m. N.R.Ahmedzade.**

1. B.T.Bilalov, **N.R. Ahmedzade**, Z.A. Kasumov, Eylem Yasar THE WEIGHTED GRAND LEBESGUE CLASS OF HARMONIC FUNCTIONS AND THE DIRICHLET PROBLEM. Meqale capa təqdim olunmuşdur.

2. **N.R. Ahmedzade**, Z.A. Kasumov, The Weighted Grand Lebesgue Class of Harmonic Functions and the Dirichlet Problem. XI International Scientific Conference "Modern Problems of Mathematics and Mechanics", July 03-06, 2024 in Baku, AZERBAIJAN, pp. 320-321.

Work № 9. Approximate solutions of stochastic differential equations and entropy optimization methods. **Executor: prof. A.Kh. Shamilov.**

1. A.Kh. Shamilov, To approximate distributions of solutions of stochastic differential equations. **Pak. J. Statist., 2024, vol.40(1), pp. 137-150.**

2. A.Kh. Shamilov, A. Nizamitdinov**,** Generalized Entropy optimization distributions: a case study application. XI International Scientific Conference "Modern Problems of Mathematics and Mechanics", July 03-06, 2024 in Baku, AZERBAIJAN, pp. 1-3.

SOCIAL ACTIVITY OF COLLABORATORS OF THE "DIFFERENTIAL EQUATIONS" DEPARTMENT

The collaboratos of the department, prof. Ziyatkhan Aliyev, prof. Tahir Gadjiev, prof. Agil Khanmamedov, Ph.D. Humay Rzayeva, ass.prof. Shamsiya Muradova, junior researcher Aishen Mammedova teaches at the universities of the Republic (BSU, AZMU, Baku Women's University) for bachelors and masters.

On March 29 and May 3, 2024, 2 doctoral students successfully defended their dissertations,under the leadership of department collaborator Prof. Ziyatkhan Aliyev, submitted for the academic degrees of Doctor of Science and Doctor of Philosophy at the Institute of Mathematics and Mechanics.

March 29, 2024 Rada Alirzak kizi Huseynova. Topic: "Investigation of the global bifurcation of fourth-order nonlinear Sturm systems."

May 03, 2024 Leila Vidadi kizi Nasirova. Topic: "One-sided global bifurcation of solutions of some nonlinear eigenvalue problems."

Total – 28 .

Article – 14 (published, prepared and submitted for publication),

Thesis – 14 .

Head of Department: Academician Yusif Mamedov