

REPORT OF “MATHEMATICAL ANALYSIS” DEPARTMENT ON SCIENTIFIC AND SCIENTIFIC ACTIVITY FOR 2022

The staff of “Mathematical Analysis” department consists of 11 research associates, including 4 doctor of sciences, professor, one corresponding member of ANAS.

1. Vagif Guliyev – head of department (doct. phys. math. sci. prof. Corr. member of ANAS).
2. Rovshan Bandaliev- doct. math. sci., senior researcher
3. Elman Ibrahimov – doct. math. sci., senior researcher
4. Hajibeyov Mubariz- doct. math. sci., senior researcher
5. Zaman Safarov - cand. phys. math. sci., ass. prof., leading researcher
6. Mehriban Omarova – ph. doctor in math., ass. prof., leading researcher
7. Elmira Hajiyeva – cand. phys. math. sci., res. ass.
8. Lala Aliyeva - ph. doctor in math., ass. prof., great researcher
9. Fatayi Isayev – ph. doctor in math., great researcher
10. Aytekin Abdullayeva – ph. doctor in math., great researcher
11. Aynur Mammadova – ph. doctor in math., great researcher

I. SCIENTIFIC PART

In 2022, according to the affirmed plan, six scientific works on the themes of “Modern problems of harmonic analysis” are carried out.

Work 1: Application and boundedness of sublinear operators generated by parabolic Calderon-Zygmund in weighted parabolic Orlicz-Morrey-type spaces.

Executors: Head of department, corr. member of ANAS, prof. V.S. Guliyev, ph. doctor in math., ass. prof., lead. res. M.N. Omarova

Works on application and boundedness of sublinear operators generated by parabolic Calderon-Zygmund in weighted parabolic Orlicz-Morrey-type spaces have been carried out. Boundedness of sublinear operators generated by parabolic Calderon-Zygmund in weighted parabolic generalized Morrey-type spaces was studied and regularization of first order derivatives of second order non-divergent parabolic equations in weighted parabolic generalized Morrey-type spaces was investigated. Based on the results of research, the following papers were published.

1. F. Deringoz, **V.S. Guliyev, M.N. Omarova**, M.A. Ragusa, *Calderon-Zygmund operators and their commutators on generalized weighted Orlicz-Morrey spaces*, Bulletin of Mathematical Sciences, 2022, 1-25. (**impact factor 1.485**) (**WoS, SCIE, Q1**)

<https://doi.org/10.1142/S1664360722500047>

1. **V.S. Guliyev, M.N. Omarova**, *Estimates for operators on generalized weighted Orlicz-Morrey spaces and their applications to non-divergence elliptic equations*, **Positivity** 26 (2022), no. 2, Paper No. 40, 27 pp. (**impact factor 0.853**) (**WoS, SCIE, Q3**)
<https://doi.org/10.1007/s11117-022-00896-z>
2. **V.S. Guliyev**, *Maximal commutator and commutator of maximal function on total Morrey spaces*. **Journal of Mathematical Inequalities**, 16(4) (2022), 1-20. (**impact factor 1.145**) (**WoS, SCIE, Q2**)
3. Kucukaslan, **V.S. Guliyev**, C. Aykol, A. Serbetci, *Maximal and Calderón–Zygmund operators on the local variable Morrey–Lorentz spaces and some applications*, **APPLICABLE ANALYSIS**, 101 (5) (2022), 1-14. (**impact factor 1.278**) (**WoS, SCIE, Q3**) <https://doi.org/10.1080/00036811.2021.1952995>
4. H. Armutcu, **M.N. Omarova**, *Some characterizations of BMO spaces via maximal commutators in Orlicz spaces over Carleson curves*, **Trans. Natl. Acad. Sci. Azerb. Ser. Phys.-Tech. Math. Sci. Mathematics**, 42 (1), 47-60 (2022). (SCOPUS)
<http://trans.imm.az/volumes/42-1/4201-05.pdf>

Theses

6. **V.S. Guliyev**, *About Sobolev-Morrey estimates for hypoelliptic operators on homogeneous groups*. **Proceedings of the 8th international conference on Control and Optimization with Industrial Applications, 2022, Vol. I, pp. 195-197.**
http://coia-conf.org/upload/editor/files/COIA2022_V1.pdf
7. H. Armutcu, **M.N. Omarova**, *Maximal commutators in Orlicz spaces over Carleson curves*. **Proceedings of the 8th international conference on Control and Optimization with Industrial Applications, 2022, Vol. I, pp. 93-95.**
http://coia-conf.org/upload/editor/files/COIA2022_V1.pdf
8. **M.N. Omarova**, *Global regularity in weighted Orlicz-Morrey spaces of solutions to elliptic equations with VMO coefficients*. **Proceedings of the 8th international conference on Control and Optimization with Industrial Applications, 2022, Vol. II, pp. 369-371.**
http://coia-conf.org/upload/editor/files/COIA2022_V2.pdf
9. **M.N. Omarova, K.A. Mustafayev**, *Boundedness of maximal operator in generalized local Morrey spaces*, *Azərbaycan Xalqı-nın Ümummilli Lideri Heydər Əliyevin anadan olmasının 99-cu ildönümünə həsr olunmuş “Riyaziyyat və Mexanikanın Aktual Problemləri” adlı Respublika Elmi Konfransı*, p. 176, 2022.
http://static.bsu.az/w9/2022/KONF2022_merged.pdf

Work 2: Compactness and boundedness of Hausdorff operator in variable exponent Lebesgue spaces.

Executors: doct. math. sci., senior researcher Rovshan Bandaliyev., cand. phys. math. sci., ass. prof., lead. res. ass Zaman Safarov

With regards to affirmed plan, compactness and boundedness of hardy operator in variable exponent discret and weighted lebesgue space were dedicated. To be more specific, necessary and sufficient conditions on the sequences defining the weight function were found for compactness and boundedness of discret hardy operator in discret variable exponent and weighted lebesgue space. To be noted that, obtained results are also valid for the adjacent operator of the discrete hardy operator. As the results of research, the following papers were published.

- 1) R.A. Bandaliyev, D.R. Aliyeva, On boundedness and compactness of discrete Hardy operator in discrete weighted variable Lebesgue spaces, **Journal of Mathematical Inequalities**, 16(3) (2022), 1215–1228. (impact factor-1.145) (WoS, SCIE, Q2)
<http://files.ele-math.com/articles/jmi-16-81.pdf>
- 2) **Aliyeva, D.R., Bandaliyev, R.A.**, On a sharp constant in generalized Minkowski inequality on variable Lebesgue space, **Trans. Natl. Acad. Sci. Azerb. Ser. Phys.-Tech. Math. Sci.** 42 (4), 22–28 (2022). (Scopus, Elsevier).
<https://trans.imm.az/inpress/>
- 3) **R.A. Bandaliyev, K.H. Safarova**, On the solvability of nonlinear ordinary differential equation in grand Lebesgue space, **Ukrainian Mathematical Journal**, 74(7)(2022), 1011-1019. (Impact factor-0.464) (WoS, SCIE, Q4)
<https://umj.imath.kiev.ua/index.php/umj>
- 4) T.K. Yuldashev, B.J. Kadirkulov, **R.A. Bandaliyev**, On a mixed problem for Hilfer type fractional differential equation with degeneration, **Lobachevskii J.Math.** 43(1) (2022), 263–274. (Impact factor-0.620) (WoS, ESCI, Q3)
<https://link.springer.com/article/10.1134/S1995080222040229?noAccess=true>
- 5) **R.A. Bandaliyev, E.A. Ibayev, K.K. Omarova**, A semi-Markov random walk process and its connection with fractional order differential equation, **Markov processes and Related Fields**, 22 (5) (2022), 654-668. (Impact factor-0.441) (WoS, SCIE, Q4)
- 6) J.J. Hasanov, **Z.V. Safarov**, Hardy-Littlewood-Stein-Weiss theorems for Riesz potentials in modified Morrey spaces, **Baku Mathematical Journal**, 2022, vol.1, No 1, pp 37-46.

<https://www.bakumathj.org/archive/Vol1No1/j.bmj.004.pdf>

- 7) C. Avsar, A.M. Musayev, **Z.V. Safarov**, Two-Weighted Inequalities For Generalized Fractional Integral Operator And Its Commutators In Generalized Weighted Morrey Spaces, **Journal of Mathematical Analysis**, 2022, Vol. 13, Issue 4 (2022), pp. 1-14. (Impact factor-- 0.620) (WoS, Q3)

<http://www.ilirias.com/jma/repository/docs/JMA13-4-1.pdf>

Theses

1. **R.A. Bandaliyev**, K.H. Safarova. Connection of the Riemann-Liouville fractional integral with the nonlinear fractional integrodifferential equation in Lebesgue spaces. Proc. 8th Inter. Conf. on COIA, Baku, 24-26 August, 2022, p. 138-140.
http://coia-conf.org/upload/editor/files/COIA2022_V1.pdf
2. **R.A. Bandaliyev**, K.H. Safarova. On discrete Hardy type inequality in variable weighted discrete Lebesgue spaces. Modern Prob. Math. Mech. Proc. Inter. Sci. Conf. dev. 11-th anniver. acad. I. Ibrahimov, Baku, June 29-July 1, 2022, p. 66.
3. **Z.V. Safarov**, Two-Weighted Inequalities For Generalized Fractional Integral Operator In Generalized Weighted Morrey Spaces. EGE International Congress On Innovation Technologies And Engineering. September 02-04, 2022 Ege University, Izmir, Türkiye

3) İŞ: Hiperqruplarda verilmiş maksimal və kəsr maksimal operatorların dəyişən dərəcəli Lebeq fəzalarında məhdudluğu.

Executors: doct. math. sci., senior researcher Hajibeyov Mubariz. , cand. phys. math. sci., res. ass Elmira Hajiyeva

Hardy-Littlewood maximal function and Riss potential were investigated in commutative hipergroups. Weak (1,1) and strong (p, p) type boundedness of Hardy-Littlewood maximal function was proved. Moreover, We have proved theorem on hipergroups analogous to Hardy-Littlewood-Sobolev for Riss potential.

1. Mubariz G. Hajibayov, *Hardy-Littlewood Maximal Functions and Fractional Integrals on Hypergroups*, **Thai Journal of Mathematics**, Vol. 20, No. 1 (2022), Pages 1–11, (WoS, ESCI).

<http://thaijmath.in.cmu.ac.th/index.php/thaijmath/article/view/908/354354966>

Work 4: The two-weighted inequalities for maximal fractinal and fractional integral commutators generated by Gegenbauer differential operator.

Executor: doct. math. sci., senior researcher Elman Ibrahimov

During annual report, sufficient condition for boundedness of commutator of Gegenbauer fractional differential operator on weighted spaces was proved. Also, sufficient condition for boundedness of commutator of Gegenbauer maximal differential operator on weighted spaces was proved.

Some papers for the two-weighted inequalities for maximal fractional and fractional integral commutators generated by Gegenbauer differential operator is prepared as an article and accepted for publication. **E.J. Ibrahimov**, S.Ar. Jafarova, Boundedness of commutators of G-fractional integral with G-BMO functions.

Work 5 : Two-weighted inequalities for the commutator of sublinear operator derived from B-singular integral.

Executors: cand. phys. math. sci., ass. prof., great researcher Lala Aliyeva, ph. doctor in math., great researcher Fatayi Isayev

Works on two-weighted inequalities for the commutator of sublinear operator derived from B-singular integral are carried out. Moreover, Fatayi Isayev investigated boundedness of Dini type Calderon-Zygmund singular operators and their commutators on generalized local Morrey space. Also, during annual report, L. Aliyeva investigated relations between generalized higher order generalized locally summable oscillation and higher order oscillation and proved a theorem about isomorphism of functional spaces which is obtained with the help of given results. Also, Zygmund type estimates was obtained for multidimensional integral operator on generalized higher order oscillation. and proved a theorem about boundedness of singular integral operator which is obtained with the help of generalized oscillation. Obtained results were published as an article.

1. **V.S. Guliyev, F.A. Isayev**, A.Serbetci, *Multilinear Calderon-Zygmund operators with kernels of Dini's type and their commutators on generalized local Morrey spaces*, **Trans. Natl. Acad. Sci. Azerb. Ser. Phys.-Tech. Math. Sci. Mathematics**, 42 (4), 1-19 (2022). (Scopus, Elsevier).
<http://trans.imm.az/inpress/4204-10.pdf>
2. **L.R. Əliyeva**, R.M.Rzaev, L.E.Huseinova, Singular integral operator in spaces defined by a generalized oscillation, **Ukrainian Mathematical Journal**, vol. 73, No. 9, February 2022, Ukrainian, pp. 1428-1444. . (Impact factor-- 0.260) (WoS, SCIE, Q4)
<https://link.springer.com/article/10.1007/s11253-022-02003-7>

Theses

1. **L.R.Alieva**, A.A.Tagiyeva, Riemann boundary value problem in generalized Hardy classes, Karabakh III International Congress of Applied Sciences "Year of Shusha-2022", vol.1, pp. 276-277, June 7-10, 2022, Karabakh/Azerbaijan
2. **L.R.Alieva**, A.A.Babayev, On some properties of a singular operator on terms of generalized oscillation, Modern Problems of Mathematics and Mechanics n International Conference devoted to the 110-th anniversary of academician İbrahim İbrahimov, p.37, June 29-1 July, 2022, Baku, Azerbaijan.
3. **L.R.Alieva**, R.M.Rzaev, Singular integral operator in spaces defined by generalized oscillation, International Congress on Innovation Technologies and Engineering, 2022. Ege University, pp.45-46, September 2-4, 2022, Izmir, Turkey.

İŞ: 6. Modulus of continuity in weighted Lebesgue spaces. Estimates for averaging function in sense of Sobolev in weighted Lebesgue space.

Executors: ph. doctor in math., great researcher Aytekin Abdullayeva, ph. doctor in math., great researcher Aynur Mammadova.

Works on estimates for averaging function in sense of Sobolev in weighted Lebesgue space are carrying out. With the help of compactness of Lebesgue space, have been proved theorem on Besov space analogous to Kolmogorov-Riss type theorem. Obtained results are prepared as an article and has been submitted to a prestigious journal in the relevant direction.

1. **A.E. Abdullayeva, A.N. Mammadova**, On compactness of sets in the weighted Besov spaces, **Modern Problems of Mathematics and Mechanics n International Conference devoted to the 110-th anniversary of academician İbrahim İbrahimov**, p.22, June 29-1 July, 2022, Baku, Azerbaijan.

II SCIENTIFIC ORGANIZATIONAL ACTIVITY

- The main priority of the department is modern problems of harmonic analysis.
- In the department the research works are carried out on 6 themes.
- The department staff consists of 16 collaborators. Four of them are doctor of sciences (one of them is professor of ANAS, corr. member of ANAS), 4 associate professor, 4 senior res. ass., 4 res. ass., 2 engineer programmer, 1 senior laboratory assistants, 2 laboratory assisstants.

Prof. V.S. Guliyev, doc. R.A. Bandaliyev, doc. E.C. İbrahimov, ph.d. F.A. İsayev, ph.d. M.N. Omarova, ph.d. L. Aliyeva, A.E. Abdullayeva, A.N. Mammadova regularly take part in the institute seminars. In the first quarter of annual report, doc. R.A. Bandaliyev ,doc. M.Q.Hajibayov and doc. E.C. İbrahimov delivered lectures in the instute seminar .

- The seminar "Actual problems of harmonic analysis" led by prof.V.S.Guliyev is held every friday of the week. Prof.V.S.Guliyev prof. of ANAS R.A.Bandaliyev ass prof. M.N.Omarova A.E.Abdullayeva A.N.Mammadova have given presentations in these seminars.

Prof.V.Guliyev has continued his activity as a member of the The High Attestation Commission under the President of the Republic of Azerbaijan.

Prof.V.Guliyev is one of the editors-in-chief of "Caspian journal of applied mathematics, ecology and economics" , editor-in-chief in mathematics issues of "AMEA-nın Xəbərləri" (Fizika-texnika və riyaziyyat elmləri seriyası) while being also member in the editorials board of many international "Journal of Nonlinear Sciences and Applications" (J. Nonlinear Sci. Appl.), "Applied and Computational Mathematics", "Eurasian Mathematical Journals", "Communications de la Faculté des Sciences de l'Université d'Ankara. Séries A1. Mathematics and Statistics", " TWMS Journal of Pure and Applied Mathematics" and other local Proceedings of Institute of Mathematics and Mechanics of NAS of Azerbaijan", "Azerbaijan Journal of Mathematics" journals.

Prof. V.S. Guliyev also was a reviewer of the papers from "Journal of Mathematical Analysis and Application, Mathematische Nachrichten, Journal of Fourier Analysis and Application, Journal of Mathematical Inequalities , Integral transform and Special Functions , Journal of Function Spaces, Communications in Mathematical Analysis , Complex Variables and Elliptic Equations , Journal of Inequalities and Applications, Collectanea Mathematica " and other impact factor journals.

Starting from 2019, in every october, Stanford University, USA, publishes a ranking list of the world's most influential scientists. The rating list has been compiled based on a year's worth of data from the Scopus database of Elsevier, the world's largest and most prestigious academic publisher which located in head office of Amsterdam. In this rating list, 14 scientists from 6 branches of science representing our country who are also representatives of 8 organizations. The name of Professor Vagif Guliyev in the field of mathematics was included in this list in 2022 as well as in 2021.

Prof .V.S.Guliyev led Mathematical Modeling and Simulation and Applications of Optimization Procedure in Physical Problems sections in international virtual COIA2022 conference and he participated with the lecture ***"About Sobolev-Morrey estimates for hypoelliptic operators on homogeneous groups"*** .

Sen. res. ass doct. math. R.A. Bandaliyev participated ***"Connection of the Riemann-Liouville fractional integral with the nonlinear fractional integrodifferential equation in Lebesgue spaces"*** in international virtual COIA2022 conference.

Ph. doctor in math., sen. res. ass. Mehriban Omarova participated with “*Global regularity in weighted Orlicz-Morrey spaces of solutions to elliptic equations with VMO coefficients*” in international virtual COIA2022 conference.

Sen. res. ass doct. math. R.A. Bandaliyevs also was a reviewer for many papers which are submitted for international journals. Of these, we can refer to "Bulletin of the Malaysian Mathemaical Sciences Society", "Positivity", "Journal of Mathematical Analysis and Applications", "Mathematical Methods in the Applied Sciences", "Communications Faculty of Sciences University of Ankara Series A1: Mathematics and Statistics", "Journal of Pseudo-Differential Operators and Applications" journals.

The number of citations in WoS-Clarivate Analytics to Prof.V.S.Guliyevs papers is 1754, in MathSciNet mathematical Review is 1519, in Google Scholar is 4720.

In 2022, the number of citations to Prof.V.S.Guliyevs papers is 499 in Google Scholar.

The number of citations in WoS-Clarivate Analytics to Sen. res. ass doct. math. R.A. Bandaliyevs papers is 145, in Google Scholar is 393.

In 2022, the number of citations to Sen. res. ass doct. math. R.A. Bandaliyevs papers is 39 in Google Scholar.

The number of citations in WoS-Clarivate Analytics to cand. phys. math. sci., ass. prof., lead. res. ass Elman Ibrahimovs papers is 28, in Google Scholar is 104.

In 2022, the number of citations cand. phys. math. sci., ass. prof., lead. res. ass Elman Ibrahimovs papers 1 in Google Scholar.

The number of citations in WoS-Clarivate Analytics to doct. math. sci., senior researcher Hajibeyov Mubarizs papers is 28, in Google Scholar is 86.

In 2022, the number of citations to doct. math. sci., senior researcher Hajibeyov Mubarizs papers is 4 in Google Scholar.

The number of citations in WoS-Clarivate Analytics to cand. phys. math. sci., ass. prof., lead. res. ass Zaman Safarovs papers is 12, in Google Scholar is 70.

In 2022, the number of citations to cand. phys. math. sci., ass. prof., lead. res. ass Zaman Safarovs papers is 15 in Google Scholar.

The number of citations in WoS-Clarivate Analytics to ph. doctor in math., sen. res. ass. Mehriban Omarovas papers is 36, in Google Scholar is 378.

In 2022, the number of citations to ph. doctor in math., sen. res. ass. Mehriban Omarovas papers is 65 in Google Scholar.

Department employee R.A. Bandaliev is a member of the ED 1.04 dissertation council, operating at the RMI of the National Academy of Sciences of Azerbaijan, employees E.J. Ibragimov and M.G. Hajibeyov - members of a special thematic seminar at the dissertation council.

Under the management of Prof V.Guliyev as an editor-in-chief, **vol. 42 no. 1, 2022** and **vol. 42 no. 4, 2022** issues of "Transactions of Azerbaijan National Academy of Science, Issue Mathematics, Series of physical-technical and mathematics science" was released.

Department employee R.A. Bandaliev is a member of the ED 1.04 dissertation council, operating at the RMI of the National Academy of Sciences of Azerbaijan, employees E.J. Ibragimov and M.G. Hajibeyov - members of a special thematic seminar at the dissertation council.

During annual report, in the international International Ege Conference hosted by Turkey , Izmir cand. phys. math. sci., ass. prof., great researcher Lala Aliyeva participated with the plenary lecture .

Also, she participates as an expert in the process of accreditation assessment of higher education institutions is ongoing under the organization of the Training and Methodology Department of the Agency for Quality Assurance in Education and has completed successfully .

DEFENSES

In this year, Sabir Hasanov made his dissertation defense over 'Boundedness criterions for fractional-maximal, fractional-integral operators and their commutators on Orlich and generalized Orlich-Morrey spaces.

PUBLICATIONS

In the second quarter of annual report, 26 scientific articles (11 of them on Web of Sciences's list) and 11 theses of department staff were published, 12 paper were accepted for publication, 15 of them are presented to publication.

In the annual report 2022, general number of citations to the staff of "Mathematical Analysis" department is more than 600.

Head of the department
"Mathematical Analysis"

Corr. member of NASA,
prof. V.S. GULIYEV