

Semi-annual report of the department of “Function Theory” for 2023

Scientific direction: Harmonic, nonharmonic analysis and approximation theory

Topic: “Approximation of functions of many variables by ridge functions, neural networks, linear and nonlinear superpositions, embedding theorems for functional spaces”

On scientific activity

In the reporting period, 5 works connecting 6 researchers on the subject "Approximation of functions of many variables by ridge functions, neural networks, linear and nonlinear superpositions, and embedding theorems for functional spaces" were carried out. 5 papers were published. 4 of these articles were published in journals indexed in the databases Clarivate Analytics "Web of Science" and "Scopus". In addition, 4 abstracts were published and 1 article was submitted for publication.

About works

Work 1: On a generalization of the Hecht-Nielsen theorem

(Executors: dr. math. sci., prof. Vugar Ismailov and PhD Aida Asgarova)

Published works:

1. Vugar E. Ismailov, “A three layer neural network can represent any multivariate function”, *Journal of Mathematical Analysis and Applications* 523(1) (2023), Article 127096.

<https://www.sciencedirect.com/science/article/abs/pii/S0022247X23000999>

2. Aida Kh. Asgarova, Representation by a sum of algebras in the space of continuous functions, *Modern Problems of Mathematics and Mechanics*, Proceedings of the International Conference dedicated to the 100-th anniversary of the National Leader Heydar Aliyev, 26-28 April, 2023, Baku, p. 111-112.

<https://mpmm.imm.az/wp-content/uploads/2023/05/Abstract-Aliyev-100-2023.pdf>

Work 2: Some differential properties of functions from generalized grand Lebesgue-Morrey spaces

(Executor: dr. ph.-m. s., prof. Alik Najafov)

Published works:

1. A.M. Najafov, A. Eroglu, F.F. Mustafayeva, On some embedding theorems in grand Nikolskii-Morrey spaces with dominant mixed derivatives, *Trans. of A. Razmadze Math. Institute* v. 177, No. 1, 2023, 85-92.

[https://rmi.tsu.ge/transactions/TRMI-volumes/177-1/v177\(1\)-11.pdf](https://rmi.tsu.ge/transactions/TRMI-volumes/177-1/v177(1)-11.pdf)

2. A.M. Najafov, L.Sh. Gadimova, On embedding theorems in generalized grand weighted Sobolev spaces, *Modern Problems of Mathematics and Mechanics*, Proceedings of the International Conference dedicated to the 100-th anniversary of the National Leader Heydar Aliyev, 26-28 April, 2023, Baku.

<https://mpmm.imm.az/wp-content/uploads/2023/05/Abstract-Aliyev-100-2023.pdf>

The work submitted for publication:

1. A.M.Najafov, A.Eroglu, F.F.Mustafayeva, On some differential properties of functions from generalized grand Sobolev-Morrey spaces.

Work 3: Approximations of singular integral transformations in some functional spaces and investigation of the properties of discrete singular transformations

(Executor: dr. math. sci., prof. Rashid Aliev)

2 papers were published:

1. Aliev R., Ismailov E., Jackson-type theorem in the weak L_1 -space, *Turkish Journal of Mathematics*, **47 (2023)**, 185-194.

<https://doi.org/10.55730/1300-0098.3353>

2. Aliev R.A., Samadova L.G., Boundedness of the Discrete Hilbert transform in Discrete Hölder spaces, *Baku Mathematical Journal*, **2:1 (2023)**, 47-56

<https://doi.org/10.32010/j.bmj.2023.04>

1 abstract was published:

1. Aliev R.A., Samadova L.G. Discrete Hilbert transform in Discrete Hölder spaces, *Modern Problems of Mathematics and Mechanics*, Proceedings of the

International Conference dedicated to the 100-th anniversary of the National Leader Heydar Aliyev, 26-28 April, 2023, Baku, pp. 64-66.

<https://mpmm.imm.az/wp-content/uploads/2023/05/Abstract-Aliyev-100-2023.pdf>

Work 4: "Correct" estimates and their application in the theory of approximation of periodic functions in one and different metrics

(Executor: cand. ph.-m. s., associate professor Niyazi Ilyasov)

1 paper was published:

1. Н. А. Ильясов, Порядковые равенства в пространствах $L_p(T)$, $1 < p < \infty$, для наилучших приближений и модулей гладкости производных периодических функций с монотонными коэффициентами Фурье, Труды ИММ УрО РАН 2022, том 28, номер 4, 103-120.

https://www.mathnet.ru/php/archive.phtml?wshow=paper&jrmid=timm&paperid=1954&option_lang=rus

Work 5: Obtaining a dual relationship in the problem of approximation with RBF neural networks

(Executor: cand. ph.-m. s., associate professor Ibrahim Maharov)

1 abstract was published:

1. Ibrahim K. Maharov, Upper bound for the approximation error of RBF neural networks with two hidden nodes, *Modern Problems of Mathematics and Mechanics*, Proceedings of the International Conference dedicated to the 100-th anniversary of the National Leader Heydar Aliyev, 26-28 April, 2023, Baku, pp. 237-238.

<https://mpmm.imm.az/wp-content/uploads/2023/05/Abstract-Aliyev-100-2023.pdf>

On scientific-organizational activity:

In the reporting period, the senior researcher of the department cand. ph.-m. s., associate professor, Niyazi Ilyasov made a presentation on "On various

properties of periodic summable functions with only one condition on modulus of continuity of the second order” at the institute seminar.

In the reporting period, the chief researcher of the department, dr. math. sci., prof., Rashid Aliev was the chairman of the section Approximation Theory in the International conference "Modern Problems of Mathematics and Mechanics" dedicated to the 100th anniversary of the national leader Heydar Aliyev.

Head of department Vugar Ismailov was a reviewer of the journals: Neural Networks and Neural Processing Letters.

Head of the department

Dr.Math.Sci., prof. Vugar Ismailov