

**On scientific and scientific – organizational activities of “Functions
Theory” department of IMM for 2017**

On scientific activity

In the reporting period, four works on “approximation of functions of many variables by ridge functions, neural networks, linear and nonlinear superpositions, inclusion theorems for function spaces” were executed. In the reporting period 13 papers (9 of them in Thomson Reuter journals) were published. Four papers were submitted for publication.

About works:

Work 1. Applications of theory of measure to the problem of approximation by neural networks.

(ex: dr. of sci. in math. V.E. Ismailov, head of department)

In the reporting period, necessary and sufficient conditions, in terms of certain Borel measures, for the density of single hidden layer neural networks with weight vectors varying in finitely many directions and with thresholds from an open interval in the space of continuous functions were given.

The published papers:

1. A.Kh. Asgarova, V.E. Ismailov, Diliberto–Straus algorithm for the uniform approximation by a sum of two algebras, Proc. Indian Acad. Sci. Math. Sci. 127 (2017), no. 2, 361-374. (Thomson Reuters SCIE)
2. V. Ismailov, E. Savas, Measure theoretic results for approximation by neural networks with limited weights, Numerical Functional Analysis and Optimization 38 (2017), no. 7, 819-830. (Thomson Reuters SCIE)
3. V.E. Ismailov, Approximation by sums of ridge functions with fixed directions, St. Petersburg Math. J. Vol. 28 (2017), No. 6, Pages 741–772. (Thomson Reuters SCIE)

4. V.E. Ismailov, On the uniqueness of representation by linear superpositions, Ukrainian Mathematical Journal 68 (2017), no. 12, 1874-1883. (Thomson Reuters SCIE)
5. V.E. Ismailov, A note on the equioscillation theorem for best ridge function approximation, Expo. Math. 35 (2017) 343–349. (Thomson Reuters SCIE)
6. A.Kh. Asgarova, V.E. Ismailov, On the representation by sums of algebras of continuous functions, C. R. Acad. Sci. Paris 355 (2017), 949–955. (Thomson Reuters SCIE)

Work 2. Some properties of functions from Besov-Morrey type spaces.

(ex: dr. phys. math. sci. prof. lead. res. ass. A. M. Najafov)

Some Besov-Morrey spaces with a group of variables and grand Sobolev – Morrey spaces were studied. In other words, at first these spaces were introduced and then some difference-differential and differential properties of functions from these spaces were studied. Then the obtained theoretical results were applied to a class of higher order differential equations.

Published papers:

1. Najafov Alik Malik, Orujova Aygun Tofik, On the solution of a class of partial differential equations, Electron. J. Qual. Theory Differ. Equ. 2017, No. 44, 1-9. (Thomson Reuters SCIE)
2. А.М.Наджафов, Л.Ш.Кадимова, З.В.Сафаров О свойствах функций из пространства Лизоркина-Трибеля многих пачек переменных. Journal of Qafqaz University, 2016

The papers admitted for publication:

1. Alik M. Najafov, Nilufer R. Rustamova, Some properties of grand Sobolev-Morrey type spaces. Transactions of A. Razmadze Mathematical Institute (Thomson Reuters SCIE)

2. Alik M. Najafov, Rovshan F. Babayev "Some properties of functions from generalized Sobolev-Morrey type spaces" *Mathematica Aeterna*

3. Alik M. Najafov and Rena E. Kerbalayeva The embedding theorems for Besov-Morrey spaces of many groups of variables, *Georgian Math. J.*

The published abstracts:

1. А.М.Наджафов, Гасымова А.М. О некоторых свойствах функций из пространства Лизоркина-Трибеля-Морри. SDU-nun yaradılmasının 55 illiyinə həsr olunmuş "Riyaziyyatın nəzəri və tətbiqi problemləri" Beynəlxalq elmi konfrans, Sumqayıt 2017, səh.86.

2. Alik M. Najafov On properties of functions in the grand Sobolev-Morrey spaces, International conference on "Operators in Morrey-type spaces and applications" Dedicated to 60th Birthday of Professor Vagif S. Guliyev 10-13 July, 2017 Kirşehir / Turkey, p. 43

3. Alik M.Najafov, Nilufer R. Rustamova The embedding theorems of space $S_{p,\varphi,\beta}^l W(G)$, International conference on "Operators in Morrey-type spaces and applications" Dedicated to 60th Birthday of Professor Vagif S. Guliyev 10-13 July, 2017 Kirşehir / Turkey, p. 44.

Work 3. Expression of a finite complex measure on upper half-plane by boundary values of Cauchy type integral and properties of boundary values.

(ex: cand. ph. math. sci. lead. res. ass. R.A. Aliev)

Expression of a finite complex measure on upper half-plane by boundary values of Cauchy type integral was studied and using the integral notions being the generalized Lebesgue integral, the properties of boundary values of Cauchy type integral of a finite complex measure were studied.

In the report R. Aliev has represented his doctoral dissertation “Boundary properties of Cauchy type integrals of complex measures and some problems of approximation of functions” to Dissertation Board D 01.111 at IMM.

Published papers:

1. Rashid A. Aliev, “Representability of Cauchy-type integrals of finite complex measures on the real axis in terms of their boundary values”, *Complex Variables and Elliptic Equations*, **62:4** (2017), 536-553. (Thomson Reuters SCIE)

2. Akif D. Gadjiev, Rashid A. Aliev, “Korovkin type theorem for linear k -positive operators in a polydisc of analytical functions”, *Math. Slovaca*, **66:5** (2016), 1179-1186. (Thomson Reuters SCIE)

3. Rashid A. Aliev, Chinara A. Gadjieva, “Approximate solution of hypersingular integral equations with Cauchy kernel”, *Transactions of NAS of Azerbaijan, Issue Mathematics*, **37:1** (2017), 20-29.

4. Rashid A. Aliev, “О равенстве Рисса для преобразования Гильберта конечных комплексных мер”, *Вестник БГУ, серия физико-математических наук*, №1 (2017), 41-48.

Work 4. Approximation by ridge functions in compact convex sets.

(ex: cand. ph. math. sci. sen. res. ass. I.K. Maharov, cand. ph. math. sci. sen. res. ass. A.M-B. Babayev)

Double type formula for calculating the error in approximation of the function given in any compact convex set of n -dimensional Euclidean space by ridge functions, was obtained.

Ibrahim Maharov and Arzu Babayev are executors of the program “Approximation by neural networks and some issues of frames” supported by the Presidium of ANAS.

In the reporting year, one paper was published and one paper was submitted for publication. Both papers are supported by the above-mentioned program.

Published papers:

A.Kh. Asgarova, A.M-B. Babaev, I.K. Maharov, On the error of approximation by ridge functions with two fixed directions, Tbilisi Mathematical Journal 10(2) (2017), 111-120.

The paper submitted for publication:

A.Kh. Asgarova, A.M-B. Babaev, I.K. Maharov, On the error of approximation by radial basis functions with fixed centers and RBF neural networks.

On organizational activity

In the reporting period, the head of department, dr. of sci. in math. Vugar Ismailov, lead. res. ass. dr. phys. math. sci. prof. Alik Najafov, lead. res. ass. cand. ph. math. sci. Rashid Aliev have participated at the institute seminars.

On 02.03.2017-18.03.2017 the head of department, dr. of sci. in math. Vugar Ismailov was on a professional trip at Oxford University. The goal of this visit was to give a talk at the Functional Analysis seminar, to carry out scientific discussions with Prof. C.Batty and other researchers of the Oxford Mathematical Institute and participation at various seminars.

He has given a lecture “Representation of $C(X)$ as a sum of its subalgebras and some applications” at the Functional Analysis seminar at Oxford University.

Brief content and goal of the talk may be found at the site of Oxford University (see: <https://www.maths.ox.ac.uk/node/24710>). The talk deals with representation of the space of continuous function as a sum of its subalgebras.

Head of department dr. of sci. in math. Vugar Ismailov, cand. ph. math. sci. Ibrahim Maharov, doc. phys. math. sci. prof. Arzu Babayev and Aida Asgarova are the participants of the program “Approximation by neural networks and some issues of frames” supported by the Presidium ANAS. In the framework of this program, two papers were published, two papers are in print.

On September 18, 2017, the lead. res. ass. of the department, cand. ph. math. sci. Rashid Aliev gave a talk on “Generalized integrals and boundary values of Cauchy-type integrals” at the “St. Petersburg seminar on operator theory and functions theory seminar” at St. Peterburg branch of V.A. Steklov Mathematics Institute.

Lead. res. ass. of the department cand. ph. math. sci. Rashid Aliev has submitted his doctor of sciences degree dissertation by the specialty 1202.01- Analysis and functional analysis “Boundary properties of Cauchy type integrals of complex measures and some problems of approximation of analytic functions” to the Dissertation Board D.01.111 of IMM.

The junior res. ass. of the department Aygun Orujova received affirmation of her Phd scientific title on the theme “Inclusion theorems in generalized Besov-Morrey type spaces”. Aygun Orujova and senior laboratory assistant Aida Asgarova have received “Certificate” on finishing the training course on Vikiedia organized at the Institute of Information Technologies of ANAS. They are the members of Viki group at the Institute. On May 25-26, Aygun Orujova has participated at the international conference “Theoretical and applied problems of mathematics” devoted to 55 years of SSU and gave a talk on “Interpolation theorem for Nikolski-Morrey type spaces”.

Senior laboratory assistant of the department Aida Asgarova has actively participated at the scientific and organizational works of the department and works on her dissertation work “Approximation by the sum of subalgebras of the space of continuous functions”. In 2017 she has published 3 papers. These papers were published in authoritative international journals (Comptes Rendus Paris Academy of Sciences, Proceedings of Indian Academy of Sciences, Tbilisi Mathematical Journal). These journals are published by authoritative publishers as Elsevier, Springer, de Gruyter and were included into Thomson Reuters database.

Head of the department

Professor of ANAS, Dr. Vugar Ismailov