

**On annual report of “Computational mathematics and Informatics ”
department for 2017.**

On scientific activity.

The department has a staff of 13 collaborators: senior research associate-2, research associate-1, engineer-programmer-7, senior laboratory assistant-1, laboratory assistants-1. Four of them is candidate of sciences. One of them works on dissertation.

About separate works.

Work 1. Methodical elaboration of control of distributed parameter dynamic systems from the point of view of computer technology.

(Ex: ph.D. in techn. sci. H. A. Nagiev, head of department)

Mapping of the set of solutions of partial differential equations (convective substance transfer of ideal displacement chemical reactor) onto the three-dimensional moments space was mathematically composed and properties of these mapping were studied on a specific example. The basis functions related to mutual unique mapping of an infinite dimensional space covering the Gauss function class on three-dimensional moment's space were determined.

It was shown that the considered model is useful for analysis of distributed parameter systems of the notion of trajectory and space portrait, and this result was verified by calculation experiment on a specific example.

The obtained results were published in 3 papers:

1. Нагиев Г., Алиева Ф. Оптимальное управление загрузкой установок гидроочистки топлив с учетом меняющейся сернистости поступающего сырья. // «Изв. вузов. Химия и хим. технология». г. Иваново. 2017. Т. 60. Вып. 2. С. 91-97.

2. Нагиев А. Г., Алиева Ф. А., Нагиев Г. А. Численное исследование колебательных режимов химико-технологических процессов с распределенными параметрами на примере гидроочистки моторных топлив // «Химическое и нефтегазовое машиностроение». Москва. № 7–2017. С. 11-15.

3. Нагиев Г. А., Талыбов Н. Г., Агаев У. Х., Магеррамов З. Т., Нагиев Г. А., Салманов М. С. О математической структуре моделей динамики процессов распылительной сушки // «Нефтегазовое дело». г.Уфа. 2017. Том 15. No 1. сәһ.165-168.

2 abstracts were published:

1. Нагиев Г. А., Садыхов В. В, Гулиева. Н. А Дендритовая модель пористого зерна адсорбента как пространственно-геометрический объект со свойством фрактальности. // Sumqayıt Dövlət Universiteti və AMEA İnformasiya Texnologiyaları İnstitutu “**Riyaziyyatın tətbiqi məsələləri və yeni informasiya texnologiyaları**” III cü Respublika elmi konfransı, Sumqayıt 2016, s.202-203.

2. Нагиев Г.А., Гулиева Н. А. Двухфазная модель структуры кипящего слоя катализатора для моделирования процессов дегидрирования углеводородов // Материалы Межд. научно-технической конференции. “**Наука. Технология Производство 2017**” Уфа. УГНТУ 2017. С. 189-190.

Work2. Development of computer simulation methods for dynamic studying of steady transmission drive (mathematical simulation, computing experiments).

(Ex: ph.D. in techn., sen. res. assistant V. V. Sadykhov)

The result of the investigation shows that control of non-holonomic mechanical systems reduces to solvability of rigid relation autonomic differential equations systems. In this connection, the methods of computer solution of such

differential-algebraic relation systems were analyzed and a new method in this field is elaborated. The load characteristics of constant current drive was studied for different character load regimes. Automated control of quality of polymer materials was composed mathematically and differential equation of variety system for solving the problem, was composed. It was shown that the algorithms constructed on the base of linear substitution of dynamic systems may provide correction of such errors.

The obtained results were published in 1 paper.

1. Нагиев А.Г., Садыхов В. В, Нагиев Г. А. О проблеме апертурной задержки в цифровых системах измерения и ее аналитическом решении на основе метода матричной экспоненты // **«Измерительная техника»**. Москва. 2017. с 16-20. (iF=0.29)

2 abstracts were published:

1. Нагиев Г. А., Садыхов В. В, Гулиева. Н. А Об одном алгоритме численного анализа динамических систем дифференциально-алгебраическими связями. // Sumqayıt Dövlət Universiteti və AMEA İnformasiya Texnologiyaları İnstitutu **“Riyaziyyatın tətbiqi məsələləri və yeni informasiya texnologiyaları”** III cü Respublika elmi konfransı. Sumqayıt. 2016. s.149-150.

2. Нагиев Г. А., Садыхов В. В., Гашимова У. М. Ротационное исследование внутреннего трения вязкой среды и оценивание информативности результатов по прогнозу качества синтетических латексов. // Материалы Межд. научно-технической конференции. **“Наука.Технология Производство 2017”** Уфа. УГНТУ 2017. С.184-186.

Work 3. Record of geometrical relation function between transfer number of archwise variation and shaft rotation angle.

(Ex: cand. ph. math. sci. N. J. Jafarov)

An expression reflecting geometrical relation between transfer number of arcwise variation and shaft rotation angle was obtained. This formula was introduced to the system of differential equations as a static dependence.

N. J. Jafarov studied mathematical simulation of water balance and geological objects in Azerbaijan and published an abstract in this field.

1. N. С. Сәфәров Математико–статистическое моделирование гомогенности ландшафтов северо-восточной части Малого Кавказа (в пределах территории Азербайджана) //London / conference “GISAP” 2017.

Work 4. q-deformed discrete analogs of hermitian polynomials included in Aski sytem and development of exact solutions of one-dimensional quantum oscillator models, based on these orthogonal polynomials

(Ex: ph.D. in. physics.res.ass. A. M. Jafarova)

A pair of recurrent relations of difference equations whose exact solutions are expended by Wilson and continuous Hahn polynomials are found. The explicit form of the pair of recurrent solutions for Meixner-Pollaczek polynomials was found and their validity was proved analytically. It was shown that this pair of recurrent relations passes to the pair of the known recurrent relation for Laguerre polynomials in the limit case.

The obtained relations were submitted to the impact-factor journal in the form of the paper “On the pair of recurrence relations for the Meixner-Pollaczek polynomials”.

Two abstracts on the theme were published.

1. Сәфәрова А. М., Сәфәров Е. İ. Yeni tip fərq tənlikləri cütliklərinin dəqiq həlləri: Uilson və kəsilməz Han çoxhədliləri. // “**Riyaziyyatın nəzəri və tətbiqi problemləri**” beynəlxalq elmi konfrans materialları. Sumqayıt. 2017. s.22-23.

2. Aynura M. Jafarova, Elchin I. Jafarov Existence of a pair of new recurrence relations for the Meixner-Pollaczek polynomials. // International conference **“Operators in Morrey-type Spaces and Applications, OMTSA 2017, dedicated to 60th birthday of Professor Vagif S. Guliyev”** Kirşehir 2017. səh.56-58.

On scientific-organizational activity.

On the report period, within the scientific-research programs competition of ANAS, H. A. Nagiev has worked as a programmer on applied mathematics problems on themed “Some issues of approximation and frames in neural networks.”

On education program of magistrate (“Sabah”groups) 9 students have done practical training and our collaborators supervised them.

On October 2-6 A. M. Jafarova was officially invited to the international Conference **“ Mathematical methods in quantum theory”** held at the international interdisciplinary center on scientific computations of **Heidelberg University Germany** and gave a talk in “Qubit transfer with high fidelity in 1D fermion spin chains with nearest-neighbour interaction based on new recurrence relations for Racah polynomials”. (Link: https://typo.iwr.uni-heidelberg.de/fileadmin/user_upload/4_IWR-S_Jafarova.pdf)

On October 18 at the institute seminar reported about this event.

Within the grand projects of science Development Foundation she carries out works on additive and spin-orbital effects in low dimensional semiconductors and superconductors: application of topological structures in quantum informatics.

H. A. Nagiev and A. M. Jafarova participated at the Republican scientific-practical seminar “AzScienceNet: Existing state, possibilities and prospectives” and they were conferred appropriate certificates.

A. M. Jafarova participated at the seminar “Education-science-Startup Innovation model” project carried out according to the joint program of technical and information exchange between ANAS and European Committee (TAIEX)

On May 4, 2017 at the seminar-meeting organized by the Wiki center of the Institute of Information Technologies at the Presidium of ANAS she was awarded with a certificate.

A. M. Jafarova works in the "technical editor" of these journals: “Transactions Issue Mathematics, Series of physical-technical and mathematics science, Azerbaijan National Academy of Science”, “Transactions Issue Mechanics, Series of physical-technical and mathematics science, Azerbaijan National Academy of Science” and “Proceedings of the Institute of Mathematics and Mechanics, National Academy of Sciences of Azerbaijan”.

On 18-19 April, 2017 H. A. Nagiev and V. V. Sadykhov have participated at the republican seminar-meeting “Advantages and actual problems of electronic signature” organized as Azerbaijan Technical University.

On October 20, 2017 H. A. Nagiev and a group member of our Institute participated in the “Horizon 2020”, a European Union research and innovation program.

Head of the department, ph.D at tech.

Hasan Nagiev.