

SCIENTIFIC AND ORGANIZATIONAL REPORT
of the "Fluid Mechanics" department
for the first half of 2021

Topic: "**Development of theoretical and applied foundations of non-stationary, non-equilibrium processes under the simultaneous flow of heterogeneous systems**"

In the reporting period, in accordance with the research plan, the following studies and works were carried out:

Work 1. Investigation of non-stationary processes occurring during the joint flow of various liquid mixtures (corresponding member of ANAS, Ph.D. Panakhov G.M., Ph.D. Associate Professor Abbasov E.M., Ph.D., Associate Professor Yuzbashieva A.O.).

Within the framework of the performed studies, unsteady processes in flows were evaluated depending on the degree of rock structures consolidation during displacement of various heterogeneous systems in porous media, studies were conducted to develop practical foundations of the filtration.

Work 2. Assessment of the influence of physicochemical characteristics of liquid mixtures on the flow characteristics (corresponding member of ANAS, Ph.D. Panakhov G.M., Ph.D. Associate Professor Abbasov E.M., Ph.D., Associate Professor Agayeva G.R.).

Taking into account the fact that all systems exposed to various forms change and turn into nonequilibrium systems with a certain energy, physicochemical transformations taking place in certain areas of the reservoir, the results of changes in concentration and pressure have been studied in the oil industry, in order to control such nonequilibrium states, the features of interaction in a porous medium with different densities have been theoretically and experimentally studied, models have been constructed and applications have been substantiated.

Work 3. Development of theoretical and practical foundations for the creation of various structural forms to expand the scope of application for displacement in porous media (corresponding member of ANAS, Ph.D. Panakhov G.M., Ph.D. Museibli P.T., laboratory assistant Mammadov I.D.).

The important solutions to the issues of stability of the boundary flow under displacement, which are one of the main problems associated with the joint filtration of fluids in porous media are investigated, theoretical and practical justification is given, the evaluation of technologically effective indicators of the direction under study for various structural forms of flow is carried out.

Work 4. Investigation of the features of interaction in water basins due to different densities in a porous medium, construction of statistical models (Doctor of Technical Sciences, Associate Professor Rustamov Yu.)

The prospects for the development of mineral and thermal waters of Azerbaijan are investigated, statistical models are constructed for the features of interaction in water basins due to different densities in a porous medium.

During the reporting period, eight articles were published, two articles were accepted for publication, one article was prepared and submitted for publication, nine abstracts and conference materials were published.

A patent for inventions of the Republic of Azerbaijan was obtained: a2019 0119 Panahov G.M., Abbasov E.M. "Dry mixture for isolation of highly permeable intervals of layers and alignment of the pickup profile".

Published articles and papers, accepted for publication in the reporting period:

1. Qeyrani Pənahov, Eldar Abbasov, Renqi Jiang, The novel technology for reservoir stimulation: in situ generation of carbon dioxide for the residual oil recovery // Springer; J Petrol Explor Prod Technol, 11, 2009-2026 (2021). – pp. 2009 -2026 <https://doi.org/10.1007/s13202-021-01121-5>. **Science Citation Index Expanded 2.077 (2020). Scopus.**

2. Geylani Pənahov, Eldar Abbasov, Sayavur Bakhtiyarov, Parviz Museyibli An effect of electrokinetics phenomena on nonlinear wave propagation in bubbly liquids // Sciendo; Int. J. of Applied Mechanics and Engineering, 2021, vol.26, No.3. - pp. 177-186 <https://doi.org/10.2478/ijame-2021-0043> **Scopus; Cite Score - 1.2.**
3. Qeylani Panahov, Eldar Abbasov, Shahin Ismayilov, Vusale Balakchi In-depth isolation of highly permeable zones for reservoir conformance // Taylor & Francis; Journal of Dispersion Science and Technology; <https://doi.org/10.1080/01932691.2021.2006062>. **2.262 (2020) Impact Factor (Q2).**
4. Yasin Rüstəmov, Tahir Gadjiev The regularity of solutions higher order nondivergence elliptic equations with VMO coefficients in Orlicz-Morrey spaces // ICMSEM - 2021, Springer, Vol.1, Chapter 35, pp. 1-15 **WoS.**
5. Qeylani Pənahov, Afet Yuzbashiyeva, Ibrahim Mamedov, Elnara Mamedova Ground consolidation under the fractal filtration law // ANAS Transactions (issue Mechanics), Vol. 40, № 7, 2021. – pp. 22-29.
6. Yasin Rüstəmov, Tahir Gadjiev, T. Maqerramova Forcing the system by a drift // Matematychni Studii, Ukraina, 55, 2021. – pp. 201-205 **Skopus.**
7. Yasin Rüstəmov N. Babaev, T.Gadjiev, V. Kerimov About outlooks of development of mineral and thermal waters of Azerbaijan // ANAS Transaction, Earth Sciences Baku, 2021. – **Skopus** (accepted).
8. Yasin Rüstəmov, A. Hajiyev, Najim M.M. Mathematical Model for Control of Drainage in an Irrigation System // Behnassi M., Barjees Baig M., El Haiba M., Reed M.R. (eds) Emerging Challenges to Food Production and Security in Asia, Middle East, and Africa. Springer, Cham. <https://doi.org/10.1007/978-3-030-72987-5>.

9. Yasin Rustamov, V. Kerimov, T. Gadjiev // 11th International Conference on Geotechnique, Construction Materials and Environment, 3-5 November 2021, Kyoto, Japan.

10. Ibrahim Məmmədov Müxtəlif reofiziki xassələrə malik sıxışdırılan və sıxışdırılan sistemlərdə dayanıqlığın müəyyən edilməsi üçün təqribi üsulların işlənməsi // BDU Xəbərləri Jurnalı, Bakı Dövlət Universiteti (accepted).

Corresponding member of ANAS, Dr. Geylani Panahov, Doctor of Technical Sciences, Yasin Rustamov, Associate Professor Dr. Eldar Abbasov spoke at 6 International Conferences:

1. International Conference on Actual Problems of Applied Mechanics – APAM-2021 Samarkand, Uzbekistan October 27-29, 2021 – «Evaluation and control of gas-dynamic parameters of gas pipelines transporting heterophase mixtures»
2. International scientific and practical online conference "Innovative solutions in geology and development of TRIZ" Moscow - November 16-17, 2021 – "Regulation of the displacement front in heterogeneous formations by blocking highly permeable reservoir channels with a swelling composition"
3. First International Bilateral Workshop on Science between Dokuz Eylül University and Azerbaijan National Academy of Sciences; 19 November 2021 – “A new technique of hydrocarbons displacement from a porous medium by gas-liquid systems”.
4. II International Scientific and Practical Conference "Innovative technologies in the oil and gas industry. Problems of Sustainable development of Territories", dedicated to the 10th anniversary of the North Caucasus Federal University, December 09-10, 2021, Stavropol, Russia – "Regulation of intake capacity of injection wells with swelling compositions".
5. Bakı Mühəndislik Universiteti, II Beynəlxalq Elm və Texnologiya konfransı.
6. Questions of mathematics and information technology, All-Russian Conference with international participation, 05-07 fevral 2021, Dagestan, Makhachkala.

7. II International Congress of Applied Sciences - Azerbaijan National Academy of Sciences 8-10 November 2021/Azerbaijan.

In the reporting year, the next issue of the journal ANAS Transactions (issue Mechanics) was published – vol. 40, No. 7.

Corresponding member of ANAS Geylani Panakhov supervised the work of 3 dissertants and 2 undergraduates. The dissertation of the Department of N.S. Parviz Museibli defended his thesis and presented it to the Higher Attestation Commission under the President of the Republic of Azerbaijan. Master's student of the department Ibrahim Mammadov successfully passed the exams in connection with admission to doctoral studies.

Corresponding member of ANAS, Doctor of Technical Sciences Geylani Panakhov, Doctor of Technical Sciences, Professor Yasin Rustamov, Ph.D., Associate Professor Eldar Abbasov and Ph.D., Associate Professor Afat Yuzbashieva participated in teaching various disciplines for masters and bachelors at IMM and BSU.

During the reporting period, corresponding member of the National Academy of Sciences of Azerbaijan Geylani Panakhov, as chairman of the State Examination Commission of Baku State University, participated in graduation diploma defenses, under his leadership, one master defended his graduation diploma.

During the reporting period, employees of the department conducted a field operation at Binagady Oil Company related to the intensification of oil production at production wells No. 210127 and No. 362997 and injection well No. 232414.



Fig. 1 Field application of scientific research results - Binagadi Oil Company, Baku

Corresponding member of ANAS Panakhov G.M. and Candidate of Technical Sciences Abbasov E.M. On June 11, 2021, took part in an operational meeting in the "Gas Export Department", SOCAR held on the basis of the protocol approved by SOCAR Vice President for Oil and Gas Production and Transport Iskenderov D. to solve technological problems arising on the Hajigabul-Gazi-Magomed trunk pipeline. It was decided to use special viscoelastic compositions developed in the department in field conditions and preparatory work was carried out.

Department head,
corresponding member of Azerbaijan NAS

Geylani Panahov