

**Kompüter texnologiyaları və riyazi statistika** SCIENTIFIC AND  
**ORGANIZATIONAL REPORT**  
of the "Fluid Mechanics" department  
for the first half of 2023

Theme: Developing theoretical and applied principles for non-stationary, non-equilibrium processes arising from joint flow of heterogeneous systems.

During the reporting period the research work was carried out according to the current plan.

**Work 1. Study of consolidation effect in porous media on formation of fractal structures.**

As part of studies of this work, the formation of fractal structures in the process of fluid filtration under consolidation occurring in mountain reservoirs under the action of rock pressure was considered, and studies on the development of relevant theoretical and practical foundations in this direction were conducted.

**Work 2: Investigation of interaction properties at different densities in porous media in order to regulate non-equilibrium displacement state.**

Taking into account the fact that a considerable part of the studied reservoir systems is subjected to different types of influences (temperature, pressure, etc.), which leads to a change in their state, they acquire the properties of nonequilibrium systems with a certain energy. As applied to oil extraction processes, physical and chemical transformations occurring in certain zones of the porous medium are studied. Peculiarities of interaction at different fluid densities in porous medium are studied theoretically and experimentally. Models are built and practical methods for regulation of such states at displacement are substantiated by results of concentration and pressure changes.

**Work 3: Investigation of mutual diffusion effect in solutions on nonequilibrium state of fluids during filtration.**

Mutual displacement of fluids in porous media is accompanied by periodical changes in their flow. These changes depend on the physical and chemical properties of the displaced and displacing fluids. In porous media, changes of flow

rate in diffusion direction depending on reduction of flow velocity and mineralization of liquid are investigated.

During the reported period 7 papers were prepared, 5 of them have been published and 2 accepted for print:

1. Azizaga Kh. Shakhverdiev, Geylani M. Panahov, Renqi Jiang & Eldar M. Abbasov (2022) High efficiency in-situ CO<sub>2</sub> generation technology: the method for improving oil recovery factor, *Petroleum Science and Technology*, DOI: 10.1080/10916466.2022.2157010 (**Web of Science, Scopus**).

2. Geylani M. Panahov, Eldar M. Abbasov, Babek N. Sultanov Control of capillary instability under hydrodynamic impact on the reservoir // *Nafta-Gaz* 2023, no. 2, pp. 71–83, DOI: 10.18668/NG.2023.02.01 (**Web of Science**).

3. Geylani Panahov, Parviz Museibli, Babek Sultanov Effect of soil consolidation on the fractality of the filtration law 84-94, *JAME*, volume 28, number 1 (2023). 10.59441/ijame-2023-0008 (**Scopus**).

4. Abbasov E.M., Panahov G.M., Salmanova G.M. Phase transformations in pipeline gas transportation and methods to prevent emerging complications // *Baku Mathematical Journal*, 2023, Vol. 2, No 1, pp. 77-87. <https://doi.org/10.32010/j.bmj.2023.07>

5. Abbasov E.M., Huseynov V.G., Jafarova U.F., Nasibova S.I. In situ gas generation in dispersed systems to control structure formation // *Tran. Natl. Acad. Sci. Azerb. Ser. Phys.-Tech. Math. Sci. Mechanics*, 42 (8), 3-16 (2022)

6. Бахтизин Р.Н., Панахов Г.М., Аббасов Э.М. Регулирование течением флюидов в пористых средах с учетом электрокинетических эффектов // *Нефтегазовое дело*, №5, 2023 (accepted).

7. İbrahim J. Mamedov An investigation of the diffusion effect on the hydrodynamic parameters in the fluid's mutual displacement // *Pamukkale University Journal of Engineering Sciences* (**Web of Science**) (accepted).

Department researchers participated in the international conference "Modern Problems of Mathematics and Mechanics" dedicated to the 100th anniversary of national leader Heydar Aliyev.

Corresponding member of ANAS Gaylani Panahov was elected a member of organizing committee of the eighth international scientific conference "Actual problems of applied mathematics and information technologies - Al-Khwarizmi 2023" devoted to the 105th anniversary of National University of Uzbekistan, the 1240th anniversary of Musa al-Khwarizmi.

Prepared to print the 43rd volume, 7th issue of the journal ANAS Transactions (issue "Mechanics") for 2023.

Corresponding member of ANAS Geylani Panahov supervises 3 theses and 1 MSc.

Corresponding member of ANAS, professor Geylani Panahov has taught various disciplines at BSU, associate professor Eldar Abbasov and associate professor Afat Yuzbashieva have participated in the teaching of various disciplines for masters and bachelors at IMM and BSU.

During the reporting period, under the guidance of Corresponding Member of ANAS Geylani Panahov, Doctoral Student Babek Sultanov completed his dissertation and held its preliminary discussion.

During the reporting period, under the supervision of NANA corresponding member Geylani Panahov and associate professor Eldar Abbasov, master's students Zuleikha Sadigova and Sevinj Nasibova completed their research and defended their dissertations.

During the reporting period departmental staff conducted field operations on application of new oil stimulation methods in Binagadi Oil Company (wells No 152968, 212933, 222944, 232954 and 232619) and Karasu Oil Company (wells No 1104, 1091).

Department head,  
corresponding member of Azerbaijan NAS

Geylani Panahov