Name of the project topic. Boundary value problems for loaded differential equations and integro-differential equations with a fractional order operator: existence and construction of solutions.

Project goal. Statement and study of boundary value problems for fractionally loaded equations of heat conduction and diffusion equations of a fractional order and inverse problems for integro-differential equations with the square of a fractional analogue of the Barenblatt-Zheltov-Kochina operator.

Project Objectives.

1. Statement and study of the first BVP of heat conduction with a load in the form as a fractional integral of an order less than the order of the problem's differential part

2. Solving a fractionally loaded BVP of heat conduction in the upper half-plane (x,t) (the loaded term of the equation is presented in the form as a fractional Riemann-Liouville derivative of an arbitrary order with respect to a spatial variable)

3. Find a pair of functions, the first of which satisfies a linear integro-differential equation in partial derivatives with the square of a fractional analogue of the Barenblatt-Zheltov-Kochina operator, that contains the fractional Hilfer operator and the Riemann-Liouville integral, as well as it satisfies homogeneous Dirichlet boundary conditions for the spatial argument and two conditions for time variable t at the end point T and at some intermediate point of the change interval, and the second unknown function is contained in the first condition for the time variable t.

4. Statement and study of a BVP for a two-dimensional loaded heat equation with respect to a spatial variable (the loaded term of the equation is presented in the form of the Riemann-Liouville fractional derivative).

5. Solving a fractionally loaded BVP for a fractional order diffusion equation in the half-space (x,y,t).

6. Constructing the fundamental solutions for diffusion-wave equations

7. Find a pair of functions, the first of which satisfies a linear integro-differential equation in partial derivatives with the square of a fractional analogue of the Barenblatt-Zheltov-Kochina operator and with a variable coefficient in the term with the unknown function, as well as conditions as in Objective 3.

8. Find a pair of functions, the first of which satisfies a nonlinear integro-differential equation in partial derivatives with the square of a fractional analogue of the Barenblatt-Zheltov-Kochina operator, as well as conditions as in Objective 3.

9. Solving a BVP for an essentially loaded differential equation, when the order of the fractional derivative in the loaded term is equal to or higher than the order of the differential part, and the trace of the desired function is given on various manifolds.

10. Finding eigenfunctions and eigenvalues of accompanying singular integral equations of Volterra type in the study of BVPs for essentially loaded differential equations.

Research group and project management

No.	Full name (if available), education, degree, academic title	Hirsch index, ResearcherID, ORCID, Scopus Author ID (if available)
1	Kosmakova Minzilya Timerbaevna, PhD, associate professor	h-index 8 (Web of Science); h-index 8 (Scopus); Researcher ID AAN-8009-2020; ORCID 0000-0003-4070-0215; Scopus Author ID 56368167200
2	Ramazanov Murat Ibraevich, higher, Doctor of Physical and Mathematical Sciences, Professor	h-index 10 (Web of Science); h-index 10 (Scopus); Researcher ID U-8583-2018; ORCID 0000-0002-2297-5488; Scopus Author ID 13906494700
3	Yuldashev Tursun Kamaldinovich, Ph.D., Associate Professor, V.I. Romanovsky Institute of Mathematics of the Academy of Sciences of the Republic of Uzbekistan, leading researcher	Researcher ID: DZB-2355-2022; Scopus Author ID: 24482650300; ORCID: 0000-0002-9346-5362
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List of published works by the performers of the theme:

1. *Tursun K Yuldashev*, Khanlar R. Mamedov, Mahkambek M. Babayev. Dependence on the parameters of the solution of a mixed problem for a nonlinear integro-differential equation of the fifth order with a degenerate kernel // Journal of Contemporary Applied Mathematics. – V. 14, No 2, 2024, December. https://journalcam.com/

2. *Kosmakova M., Akhmanova D., Izhanova K.* On the solvability of a boundary value problem with a fractional derivative // Evolution Equations, Approximation and Spectral Optimization: book of abstracts of International Summer School & Conference. – Almaty, 2024, September 11 – 18. - P. 24-25. https://sites.google.com/view/eeaso-2024/abstracts/book-of-abstracts?authuser=0

3. *Kosmakova M., Akhmanova D., Izhanova K.* Solving a boundary value problem for an equation with a fractional derivative and a load in the form of a fractional integral // Actual problems of applied mathematics and information technologies Al-Khwarizmi 2024: abstracts of the IX international scientific conference, dedicated to the 630th anniversary of the birth of Mirzo Ulugbek. – Tashkent, 2024, 22-23 October. - P. 168-169. https://apmath.nuu.uz/

4. *Рамазанов М.И.,* Гульманов Н.К., Копбалина С.С. Решение граничной задачи теплопроводности в некангнической вырождающейся области // Неклассические уравнения математической физики и их приложения: тезисы докладов международной научной конференции, приуроченной к 90-летию со дня рождения академика АН РУз Тухтамурада Джураевича Джураева. – Ташкент, 2024, 24-26 октября. - С. 211.

5. *Akhmetshin A.D., Akhmanova D.M., Kosmakova M.T.* On the fundamental solution of a loaded fractional differential equation // Неклассические уравнения математической физики и их приложения: тезисы докладов международной научной конференции, приуроченной к 90-летию со дня рождения академика АН РУз Тухтамурада Джураевича Джураева. – Ташкент, 2024, 24-26 октября. - С. 54. https://numf2024.nuu.uz/Spisokdokladov.pdf