

34744





Российская Академия Наук





EURASIAN SCIENTIFIC CONFERENCE «INVERSE AND ILL-POSED PROBLEMS IN NATURAL SCIENCE AND ARTIFICIAL INTELLIGENCE»

Almaty, April 16-20, 2024

Abai Kazakh National Pedagogical University, Kazakhstan National Engineering Academy of the Republic of Kazakhstan The Institute of Mathematics and Mathematical Modeling, Kazakhstan International Mathematical Center SB RAS, Russia International Foundation of Inverse Problems, Kazakhstan Russian National Committee in industrial and applied mathematics

ЕУРАЗИЯЛЫҚ ҒЫЛЫМИ КОНФЕРЕНЦИЯ ЕВРАЗИЙСКАЯ НАУЧНАЯ КОНФЕРЕНЦИЯ EURASIAN SCIENTIFIC CONFERENCE

«ЖАРАТЫЛЫСТАНУДАҒЫ КЕРІ ЖӘНЕ ҚИСЫНДЫ ЕМЕС ЕСЕПТЕР ЖӘНЕ ЖАСАНДЫ ИНТЕЛЛЕКТ»

«ОБРАТНЫЕ И НЕКОРРЕКТНЫЕ ЗАДАЧИ В ЕСТЕСТВОЗНАНИИ И ИСКУССТВЕННЫЙ ИНТЕЛЛЕКТ»

«INVERSE AND ILL-POSED PROBLEMS IN NATURAL SCIENCE AND ARTIFICIAL INTELLIGENCE»

БАҒДАРЛАМА ПРОГРАММА PROGRAM

Almaty April 16-20, 2024

Eurasian scientific conference «Inverse and Ill-Posed Problems in Natural Science and Artificial Intelligence»

INTERNATIONAL PROGRAM COMMITTEE

CO-CHAIR:

Zhumagulov B.T. - Academician of NAS RK, President of the Mathematical Society of the Turkic World, President of the Mathematical Society of Kazakhstan, President of the National Engineering Academy of the Republic of Kazakhstan, Almaty, Kazakhstan

Kabanikhin S.I. - Corresponding member of the RAS, Director of the International Mathematical Center of the Sobolev Institute of Mathematics, Novosibirsk, Russia

MEMBERS:

MEMBERS:

Academician of NAS RK M. Otelbaev (L.N.Gumilyov Eurasian National University, Astana, Kazakhstan)

Academician of NAS RK T. Kalmenov (Institute of Mathematics and Mathematical modeling, Almaty, Kazakhstan)

Academician of NAS RK M. Kalimoldaev (Institute of Information and Computational Technologies, Almaty, Kazakhstan)

Academician of the RAS B. Chetverushkin (Keldysh Institute of Applied Mathematics RAS, Moscow, Russia)

Academician of the RAS E. Tyrtyshnikov (Marchuk Institute of Numerical Mathematics RAS, Moscow, Russia)

Academician of the RAS A. Semenov (Lomonosov Moscow State University, Moscow, Russia)

Academician of the RAS A. Shananin (Lomonosov Moscow State University, MIPT, Moscow, Russia)

Academician of the RAS M. Fedoruk (Novosibirsk State University, Novosibirsk, Russia)

Corresponding member of NAS RK M. Sadybekov (Institute of Mathematics and Mathematical Modeling, Almaty, Kazakhstan)

Corresponding member of NAS RK N. Temirbekov (National Engineering Academy RK, Almaty, Kazakhstan)

Corresponding member of NAS RK A. Tuleshov (U.Joldasbekov Institute of Mechanics and Engineering, Kazakhstan)

Professor A. Assanova (Institute of Mathematics and Mathematical Modeling, Almaty, Kazakhstan)

Professor M. Bektemessov (Abai Kazakh National Pedagogical University, Almaty, Kazakhstan)

Professor M. Jenaliyev (Institute of Mathematics and Mathematical Modeling, Almaty, Kazakhstan)

Professor B. Kanguzhin (Al-Farabi Kazakh National University, Almaty, Kazakhstan)

Professor M. Shishlenin (Sobolev Institute of Mathematics, Novosibirsk, Russia) Professor O. Krivorotko (Sobolev Institute of Mathematics, Novosibirsk, Russia) Professor I. Marchuk (Novosibirsk State University, Novosibirsk, Russia,)

Professor D. Zhakebaev (International Engineering Technological University, Almaty, Kazakhstan)

Professor B. Rysbayuly (International Information Technology University, Almaty, Kazakhstan)

Professor Yanfei Wang (Chinese Academy of Sciences, Beijing, China) Professor Jin Cheng (Fudan University, Shanghai, China)

Professor Shuhua Zhang (Tianjin University of Finance and Economics, Tianjin, China)

Professor Ye Zhang (Shenzhen MSU-BIT University, Shenzhen, China) Professor Alemdar Hasanoglu (Izmir, Turkey)

Professor Abit Asanov (Manas University, Bishkek, Kyrgyzstan)

Professor Abdygani Satybaev (Osh University, Osh, Kyrgyzstan)

ORGANIZING COMMITTEE: CHAIRMAN:

Tilep B.A. – Chairman of the Board - Rector of Abai Kazakh National Pedagogical University

MEMBERS OF THE ORGANIZING COMMITTEE:

Buribayev Y. – DSc, professor, Vice-Rector for research activities and innovation, vice-chairman

Iskakova A. – DSc, Vice-Rector for Strategy and Internationalisation

Bektemessov M. – DSc, professor, vice-chairman

Abdigapbarova U. – DSc, professor, Director of the Department of Sciences

Sydykhov B. – DSc, Director of the Institute of Mathematics, Physics and Informatics

Berdyshev A. - DSc, professor, Head of the Chair

Oshanova N. – DSc, associate professor, Head of the Chair

Bidaibekov Y. – DSc, professor

Abdiev K. – (Turan University, Almaty, Kazakhstan)

Iskakov K. – DSc, professor, L.N.Gumilyov Eurasian National University

Bakanov G. – DSc, professor, International Kazakh-Turkish University,

Nurseitov D. – DSc, KMG Engineering

Nurmukhamedova Zh. – PhD, Deputy Director for scientific work and international cooperation

Bektemessov Zh. – PhD, Al-Farabi KazNU, Head of the Chair

Shiyapov K. - PhD, Senior Lecturer

Kasenov S. – PhD, associate professor, Al-Farabi KazNU

Alimova A. – PhD, KMG Engineering

Salgozha I. – PhD, Senior Lecturer

Ryskan A. – PhD, Senior Lecturer

Scientific Secretary: PhD, associate professor Kasenov Syrym

e-mail: onz.kazakhstan@gmail.com

ONLINE ACCESS TO THE CONFERENCE VIA LINK

TIME: APR 17 2024 09:00 AM ASTANA, DHAKA EVERY DAY, UNTIL 19 APR. 2024, 3RD EVENT(S)

17 APR. 2024 09:00 AM, 18 APR. 2024 09:00 AM, 19 APR. 2024 09:00 AM

Download And Import The Following Icalendar (.Ics) Files Into Your Scheduling System. **DAILY**:

https://zoom.us/meeting/tJYvcuGpqDMrGNLz1xGN83aCNMGileeHR6rm/ics?icsToken =98tyKuCqrD4iG9KdsRuBRowQAI_4WevwplxcjY1xhk79JA4LMQLVGM9lO756FfDi

LOGIN ZOOM ONFERENCE

https://zoom.us/j/92258168126?pwd=U09HLzBXdndLNHd4NlppYXVwOElzUT09

CONFERENCE ID: 922 5816 8126

ACCESS CODE: 198826

PROGRAM

Eurasian scientific conference «Inverse and Ill-Posed Problems in Natural Science and Artificial Intelligence»

Location:

Almaty, st. Tole bi, 86 Abai KazNPU, conference room, 3rd floor, Institute of Mathematics, Physics and Informatics.

	Wednesday, April 17, 2024	
09:00-09:40 hall	Registration for participation	
	OPENING OF THE CONFERENCE	
09:40-10:00	 Welcome words: Tilep B.A. – Chairman of the Board - Rector of Abai Kazakh National Pedagogical University Zhumagulov B.T. – Academician of NAS RK, President of the Mathematical Society of the Turkic World, President of the Mathematical Society of Kazakhstan, President of the National Engineering Academy of the Republic of Kazakhstan, Almaty, Kazakhstan Kabanikhin S.I. – Corresponding member of the RAS, Director of the International Mathematical Center of the Sobolev Institute of Mathematics, Novosibirsk, Russia 	
	PLENARY SESSION	
Moderator – Professor Bektemessov Maktagali		
10:00-10:30	Well-Posed Settings of Ill-Posed Problems	
	EVGENY TYRTYSHNIKOV Academician of the RAS, Marchuk Institute of Numerical Mathematics RAS, Moscow, Russia	
10:30-11:00	The criterion of the solvability of the overdetermined Cauchy problem for	
	TYNYSBEK KALMENOV, ROGOY ALEXANDER Academician of NAS RK, Institute of Mathematics and Mathematical modeling. Almety. Kazakhatan	
11.00-11.30	Linear Regularization of Nonlinear Inverse Problems	
11.00-11.30	SERGEY KABANIKHIN Corresponding member of the RAS, Director of the International Mathematical Center of the Sobolev Institute of Mathematics, Novosibirsk, Russia	
11:30-11:50	COFFEE BREAK	
11:50-12:20	Generalized asymptotic regularization methods for inverse and ill-posed problems	

	YE ZHANG Professor in Mathematics, Beijing Institute of Technology & Shenzhen MSU-
	BIT University, Shenzhen, China
12:20-12:50	Problems of mathematical epidemiology
	SIMON SEROVAJSKY professor Al-Farabi KazNII Almaty Kazakhstan
13.00-14.00	RRFAK
14.00.14.20	About the school of inverse and ill need problems in Kazakhsten and
14.00-14.20	Russia
	MAKTAGALI BEKTEMESSOV
	Professor, Abai KazNPU, Almaty, Kazakhstan
14:20-14:50	On the recovery of internal source for an elliptic system by neural network
	approximation
	ZHANG HUI, JIJUN LIU
	PhD student, School of Mathematics, Southeast University, Nanjing, China.
14.50 15.20	Professor, Southeast University, China, Nanjing
14:30-13:20	inversion formulas for distributed order integro-differentiation operators
	ARSEN PSHU
15.20 15.50	Professor, Institute of Applied Mathematics and Automation KBSC RAS
15:20-15:50	inverse problems of acoustic sounding
	MAXIM SHISHLENIN
	Professor, Vise Director for Science, Sobolev Institute of Mathematics, Novosibirsk Russia
15:50-16:20	Simply-laced Dynkin diagrams
	TOLGA ETGU
	Department Chair, Nazarbayev University
16:20-16:40	COFFEE BREAK
16:40-17:20	Globally unsolvable evolutionary problems with critical nonlinearities
	BERIKBOL TOREBEK PhD. Institute of Mathematics and Mathematical modeling. Almaty. Kazakhstan
17:20-18:00	Mathematical modeling of tuberculosis and hiv co-infection dynamic
	based on machine learning and inverse problems
	OLGA KRIVOROTKO, A. NEVEROV, G. KAMINSKY
	Professor, Sobolev Institute of Mathematics, Novosibirsk, Russia
18:00-18:20	Discussion. Closing of the first day of the conference. Photoshoot

Thursday, April 18, 2024

Location:

Almaty, st. Tole bi, 86 Abai KazNPU, conference room, 3rd floor, Institute of Mathematics, Physics and Informatics.

08:30-09:00 Hall	Registration for participation
	PLENARY SESSION
Moderators – Professor Bektemessov Maktagali,	
Professor Maxim Shishlenin	
9:00-9:30	Multiparameter inverse problems of seismic wave propagation in geological media
	VLADIMIR CHEVERDA
	Professor, Sobolev Institute of Mathematics, Novosibirsk, Russia
9:30-10:00	Double-parameter regularization for solving the backward diffusion problem with parallel-in-time algorithm
	JUN-LIANG FU, JIJUN LIU
	PhD student, School of Mathematics, Southeast University, Nanjing, China Professor, Southeast University, China, Nanjing
10:00-10:30	On the spectral problem for the three-dimensional bi-Laplacian in the unit ball
	MUVASHARKHAN JENALIYEV
	Professor, Institute of Mathematics and Mathematical modeling, Almaty,
	Kazakhstan
10:30-11:00	Forecasting of the COVID-19 epidemic in russian regions using conditional generative adversarial neural networks
	NIKOLAY ZYATKOV
	Professor, Sobolev Institute of Mathematics, Novosibirsk, Russia
11:00-11:30	COFFEE BREAK
11:30-12:00	О гашении колебании системы стержней под воздействием внешних
	траничных усилии и возможные применения таких ташении в сейсмологии
	MUKHTARBAY OTELBAYEV, BALTABEK KANGUZHIN
12:00 12:30	Academician of NAS KK, Al-Farabi KazNO, Annaty, Kazakhstan
12.00-12.50	effect memory
	ANAR ASSANOVA
	Professor, Institute of Mathematics and Mathematical modeling, Almaty,
12 20 12 00	Kazakhstan
12:30 -13:00	Domain sampling methods for an inverse boundary value problem
	HAIBING WANG
	PhD, professor Southeast University, Nanjing, China

13.00-14.00	BREAK
14:00-14:20	Inverse problem for the moisture transfer equation: development of a method for finding an unknown parameter
	BOLATBEK RYSBAYULY professor, International University of Information Technologies, Almaty, Kazakhstan
14:20-14:40	Numerical solution of inverse problems for hyperbolic equations based on a direct data processing algorithm
	NIKITA NOVIKOV professor, Sobolev Institute of Mathematics, Novosibirsk, Russia
14:40-15:00	Inverse problems for determining the aerodynamic characteristics of aircraft using moment equation
	AUZHAN SAKABEKOV professor, Satpayev KazNRTU, Almaty, Kazakhstan
15:00-15:20	On a class of linear regression methods
	WANG YING-AO PhD student, Beijing Institute of Technology, Beijing, China
15:20-15:40	Numerical methods for solving the initial boundary value problem for the subdiffusion equation with nonlocal boundary conditions
	MURAT SULTANOV
15 40 16 00	professor, International Kazakh-Turkish University, Kazakhstan
15:40-16:00 16:00 16:20	COFFEE BREAK
10:00-10:20	The inverse problem for one class of pseudoparabolic equations
	ABIT ASANOV
16.20 16.40	Professor, Manas University, Bishkek, Kyrgyzstan
10.20-10.40	two variables
	ZUURAKAN KADENOVA
	associate professor, Institute of Mathematics of the National Academy of Sciences of the Kyrgyz Republic, Bishkek, Kyrgyzstan
16:40-17:00	System of algebraic equations containing isolated components of eigenvectors
	SAPARGALI ZHANATAUOV associate professor, Kazakh National Research Agrarian University, Almaty, Kazakhstan
17:00-17:20	On the initial boundary value problem for a hyperbolic equation with power degeneracy T12/7
	ARNAI KASYMBEKOVA associate professor, Al-Farabi KazNU, Almaty, Kazakhstan

17:20-17:40	Study of acoustic modeling in the context of analytical solutions of inverse problems of equations of multi-physical processes in multilayer media
	ARTEM SINITSIA
	PhD, associate professor, Dean of the School of Applied Mathematics,
	Kazakh-British Technical University, Almaty, Kazakhstan
17:40-18:00	Direct and inverse problems for the Burgers equation in degenerate
	domains
	MADI ERGALIEV
	PhD, Institute of Mathematics and Mathematical modeling, Almaty, Kazakhstan

Friday, April 19, 2024

Location:

Almaty, st. Tole bi, 86 Abai KazNPU, conference room, 3rd floor, Institute of Mathematics, Physics and Informatics.

	Moderators – PhD, Senior Lecturer Kadyrjan Shiyapov
	PhD, associate professor, Syrym Kasenov
09:00-09:40	Registration for participation
Hall	
9.40- 10.00	Ill-posedness of a mixed problem in a cylindrical domain for one class of
	multidimensional hyperbolic-elliptic equations
	SEDIK ALDASHEV
	Professor Institute of Mathematics and Mathematical modeling Almaty
	Kazakhstan
10.00 10.10	Inverse source problem for Kelvin Voigt equation with moment
10.00-10.10	Inverse source problem for Keivin-voigt equation with memory
	AIDOS SHAKIR
	teacher, Al-Farabi KazNU, Almaty, Kazakhstan
10:10-10:20	Circular anomaly in a rectangular search area. About one inverse
10110 10120	problem of gravimetry
	MARK SIGALOVSKY
	doctoral student, Al-Farabi KazNU, Almaty, Kazakhstan
10:20-10:30	Determination of the optimal radius of a hexagonal well arrangement
	when developing deposits using the in-situ leaching method
	NURLAN SHAYAKHMETOV
	doctoral student, Satbayev University, Almaty, Kazakhstan
10:30-10:40	Numerical simulation of seismic wave fields in temperature-dependent
	saturated porous media
	RESHETOVA GALINA
	Professor, Institute of Computational Mathematics and Mathematical
	Geophysics SB RAS, Novosibirsk, Russia

10:40-10:50	Application of inverse problems in teaching the topic of probability multiplication theorem
	BAGDAGUL KADYRBAEVA associate professor Senior Lecturer Abai Kazakh National Pedagogical
	University, Almaty, Kazakhstan
10:50-11:00	On a nonlinear inverse problem for a degenerate parabolic equation
	GUZEL ASHUROVA
	doctoral student, Al-Farabi KazNU, Almaty, Kazakhstan
11:00-11:20	COFFEE BREAK
11:20-11:30	The inverse problem of estimating the thermophysical parameters of a
	three-layer medium for hyperbolic heat conduction equations
	GAUKHAR MARAT Senior
	Lecturer, International University of Information Technologies, Almaty,
	Kazakhstan
11:30-11:40	Nonlinear inverse problem for a hyperbolic equation
	REGINA SAFIULLOVA
	associate professor, Ufa University of Science and Technology, Ufa, Russia
11:40 -11:50	Boundary value problems with an integro-differential nonlocal condition
	for fourth-order differential equations of composite type
	KHANAT KENZHEBAI
	doctoral student, Al-Farabi KazNU, Almaty, Kazakhstan
11:50-12:00	Coefficient inverse problems for the heat equation in a two-dimensional
	anisotropic medium
	AZAMAT ASUBAY
	Senior Lecturer, International University of Information Technologies,
	Almaty, Kazakhstan
12:00-12:10	Solvability of the inverse problem for a p-harmonic pseudo-parabolic
	equation
	KAIRDEN BAETOV
	doctoral student, Abai KazNPU Almaty, Kazakhstan
12:10-12:20	Coefficient inverse problem of joint transfer of heat and moisture in a porous medium
	AYYMZHAN BAITEREEVA
	doctoral student, Al-Farabi KazNU, Almaty, Kazakhstan
12:20-12:30	Direct and inverse problem of subsurface radar in the frequency domain
	ΔΙ ΜΔ S ΤΔΤΙΝ
	doctoral student, L.N. Gumilyov Eurasian National University, Kazakhstan
12:30-12:40	Processing and storage of data from experimental studies of roads in
	Akmola region

	AYNUR KUSAINOVA
	doctoral student, L.N. Gumilyov Eurasian National University, Kazakhstan
12:40-12:50	Inverse right-hand side recovery problem for a pseudo parabolic equation
	KORKEM ZHALGASOVA
	doctoral student, Auezov South Kazakhstan University, Shymkent, Kazakhstan
12:50-13:00	Analytical solution of heat conduction equations in a polar coordinate
	system
	AYGUL SATYBALDINA
	Senior Lecturer, International University of Information Technologies,
	Almaty, Kazakhstan
13.00-14.00	BREAK
14:00-14:10	Physics-Informed Neural Networks for the 1D Euler's Equations
	RINAT FAYZULIN, SULTAN ALPAR
	Student, International University of Information Technologies, Almaty, Kazakhstan
	PhD, researcher of La-Rochelle University, France
14:10-14:20	Selection method for solving the problem of subsurface radar (piecewise
	continuous media)
	DALLET BESHEVEV
	doctoral student, L.N. Gumilyov Eurasian National University, Kazakhstan
14:20-14:30	Mathematical modeling of inverse problems of prostate cancer
	development in bone
	ZHOLAMAN BEKTEMESSOV
	PhD, invited researcher of La-Rochelle University, France
14:30-14:40	Deep learning in determining seismic activity in Kazakhstan
	ASEM TORARBER doctoral student, Al-Farabi KazNU, Almaty, Kazakhstan
14:40-14:50	Solving the inverse problem for the immunological process of HIV
	infection development at an early stage
	DAVEL SUDNIN
	Research Engineer, Institute of Mathematics SB RAS, Novosibirsk, Russia
14:50-15:00	Solvability of a nonlocal conditional boundary value problem for an
	elliptic equation
	ARAV KUNTUAROVA
	Senior Lecturer, Abai KazNPU Almaty, Kazakhstan
15:00-15:10	Numerical solution of the linear heat conduction problem
	AISHABIBI KUNANUVA undergraduate student, Abai KazNPU Almaty, Kazakhstan
15:10-15:20	Necessary and sufficient conditions for the global minimum of the
	objective function

	ZAILAN TUTKUSHEVA master degree, K. Zhubanova Aktobe Regional University, Aktobe, Kazakhatan
15:20-15:30	Inverse problem to a mixed type equation with a fractional derivative in
15.20 15.50	the sense of Caputo
	ARUZHAN ALPYSBAYEVA
15:20 15:40	Special solutions of higher order differential equations
15.50-15.40	special solutions of higher of der unterential equations
	GALIYA MUKHAMEJAN
	undergraduate student, Abai KazNPU Almaty, Kazakhstan
15:40-16:00	Solution of the inverse problem of identifying parameters of a model of the dynamics of co-infection of tuberculosis and HIV using optimization methods and synthetically generated data
	AIGUL KUBEGENOVA Sonior Looturor, Zhangir Khan University, Uralsk, Kazakhstan
16:00-16:10	To teach the course "Inverse and ill-nosed problems" to undergraduates
10.00-10.10	majoring in mathematics and computer science at a pedagogical
	university
	NACIMA AKIMZHAN
	PhD, Senior Lecturer, Abai KazNPU Almaty, Kazakhstan
16:10-16:20	Modeling the distribution of pollutants in the atmosphere from industrial sources taking into account concentration
	NURLAN TEMIRBEKOV Corresponding member of NAS PK, National Engineering Academy PK
	Almaty, Kazakhstan
16:20-16:40	Discrete inverse problem for a hyperbolic equation, properties of the
	solution of a discrete direct and auxiliary problem
	CALITDEN BAKANOV
	Professor, International Kazakh-Turkish University, Kazakhstan
16:40-16:50	Solving the nonlinear Schrödinger equation using a physically informed
	neural network and tuning the adaptive activation function
	LIUSHUANG
	undergraduate student, Novosibirsk State University, Novosibirsk, Russia
16:50-17:10	Algorithm for solving the inverse hyperbolic problem of action potential
	propagation along a nerve fiber
	ARDUCANY SATVRAFY
	Professor Osh University, Osh, Kyrgyzstan
17:10-17:20	Direct and inverse problem of subsurface radar for road diagnostics
	DAUKEN KASENALIEV student, L.N. Gumilyov Eurasian National University, Kazakhstan

17:20-17:30	Exploring advanced inverse modeling techniques for estimating soil thermal conductivity along underground oil pipelines
	LAURA ERMEKKYZY doctoral student, Al-Farabi KazNU, Almaty, Kazakhstan
17:30-17:40	Algorithm for numerical solution of the boundary inverse problem for the acoustic equation
	DANA YERGALI
	undergraduate student, Al-Farabi KazNU, Almaty, Kazakhstan
17:40-17:50	Numerical methods for solving the inverse problem in the field of thermoacoustics
	AYAZHAN VOSERBAEVA
	undergraduate student, Al-Farabi KazNU, Almaty, Kazakhstan
17:50-18:00	Experimental studies using the GPR series "OKO" for various types of road clothing of the Republic of Kazakhstan
	AYNUR KUSAINOVA
	doctoral student, L.N. Gumilyov Eurasian National University, Kazakhstan
18:00-18:20	Discussion. Closing of the conference. Photoshoot.

CONTACTS

Responsible for organizing the conference: PhD, associate professor, Syrym Kasenov, PhD, Senior Lecturer Kadyrjan Shiyapov mail: syrym.kasenov@gmail.com

E-mail: <u>syrym.kasenov@gmail.com</u> <u>kadrzhan2019@gmail.com</u>

Scientific secretary of the conference: PhD, associate professor, Syrym Kasenov Abai KazNPU,

Kazakhstan, Almaty, 050010, st. Tole bi, 86 Telephone: +7 702 905 8952, E-mail: <u>syrym.kasenov@gmail.com</u>

The conference is supported by the Mathematical Center in Akademgorodok, agreement with the Ministry of Science and Higher Education of the Russian Federation No. 075-15-2022-282.





