

Moscow State University of Civil Engineering (National Research University)

Master's degree program: Mathematical and computer modeling in Civil Engineering

Degree: MSc Civil Engineering

Language of study: English

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2 years of study | on-campus | English-taught | 350 000 RUB per year

Introduction

Today, many countries of the world are facing a significant shortage of specialists, analysts with the knowledge and skills to solve practical problems, including in the field of construction, using modern digital technologies, mathematical methods and computer modeling. Our time is marked by the rapid development of digital information technologies. Artificial intelligence is playing an increasing role in construction, improving building technologies, making them more productive and reliable. Their application at all stages of the life cycle of buildings and structures is the purposeful processing and analysis of large flows of information with the coordinated application of mathematics, computer modeling and artificial intelligence. Attracting methods of machine learning, reinforcement learning requires the active use of modern areas of applied mathematics: numerical-analytical and numerical methods, probability theory and statistics, tensor calculus, etc. Modern specialists working in this direction know methods of mathematical and computer modeling, and also know how to generate and offer their own solutions to important practical, engineering problems, including those in the field of construction.

Example topics of Master theses:

- Deep learning algorithm for diagnosing and classifying defects in reinforced concrete structures;
- Modeling of damping properties of building structures made of composite and nanomaterials under dynamic loads;
- Numerical-analytical solution for the problem of thermal physics in construction;
- Mathematical and computer modeling in the basis and composition of monitoring systems for unique buildings and structures - theoretical foundations, software implementation and examples of use;

- Machine learning in advanced systems for monitoring buildings and structures;
- Mathematical (numerical) modeling of related problems of aeroelasticity (on the example of flexible large-span and/or high-rise structures);
- Determination of calculated snow loads on large-span structures based on the numerical solution of three-dimensional problems of building aerodynamics.

PROGRAMM ADVANTAGES

- Active use of mathematical and computer modeling methods in solving important practical, engineering problems
- Mastering universal theories, numerical and numerical-analytical methods, principles of mathematical and computer modeling
- Mastering important skills of practical applications of modern mathematics
- Practical work with methods and means of transmitting and processing large flows of information
- Knowledge of the specifics of the building structures, buildings and structures using modern calculation methods and computer modeling design allows graduates to work in any region of the world
- Due to the international study groups, you build your own network of professional international contacts already at the university
- Defining feature of education is a large number of individual and group creative projects
- Lectures and master classes by invited foreign scientists, joint creative projects and conferences are regularly held
- Opportunity to participate in a student exchange program with partner universities
- Opportunity to participate in the work of the Scientific Research Center "Reliability and Seismic resistance of structures" and the Scientific and Educational Center "Digital Construction and Operation"

STUDY PROCESS

Duration of the program: 120 credits.

Lectures, practical classes and individual study, several types of internship - Applied Scientific Research internship, Industry internship

HEAD OF THE PROGRAM

Galishnikova Vera Vladimirovna

Doctor of Science of Technical Sciences, Ph.D in Technical Sciences, Vice-Rector
Moscow State University of Civil Engineering (National Research University)

- Theme of the doctoral thesis: “Generalized geometrically nonlinear theory and methods of numerical analysis of the deformation and stability of spatial core systems”.
- Areas of scientific interest:
- Mathematical modeling of geometrically and physically nonlinear behavior of complex structural systems.
- Development of algorithms and non-linear analysis programs.
- Research in the field of digital modeling of construction projects.
- Development of new composite building structures based on cement binder and basalt and carbon fibers.
- Development of additive manufacturing technologies for the construction industry, including: development of additive construction technologies using one-dimensional reinforcing fillers; development of additive building technologies with simultaneous reinforcement of erected structures with composite reinforcement in the form of rods or nets based on basalt or carbon fibers; creation of new materials for use in 3D construction printing, including regional characteristics; development of computer simulation technologies and input of design information for direct digital production.
- The author of scientific articles in peer-reviewed Russian and foreign scientific journals (Higher Attestation Commission, SCOPUS, Web of Science), regularly makes presentations at international conferences on the design of building structures.
- Author of textbooks and teaching aids: “Architectural and building constructions”, “Structures of buildings and structures”, “Fundamentals of building mechanics”, “Geometrically nonlinear calculation of flat trusses and frames (Geometrically Nonlinear Analysis of Plane Trusses and Frames)”, “Design of holding constructions - Design of Retaining Structures”, “Computational Mechanics: Stationary Heat Flow (Computational Mechanics: Stationary Heat Flow)”, etc.
- Deputy editor of the scientific and technical journal "Structural Mechanics of Engineering Structures and Structures", indexed in the Higher Attestation Commission, RSCI, RSCI core, Scopus.
- Organizer and leader of annual international conferences: International Scientific and Practical Conference ENGINEERING SYSTEMS and International Congress of Scientists: International Conference on Advanced Composite Materials.

- Repeated recipient of grants from Russian and foreign scientific foundations for conducting research and organizing scientific events.