



POSSIBILITIES OF USING MODERN TECHNOLOGIES IN SOLVING PROBLEMS IN MECHANICS BASED ON MODELING

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A B S T R A C T	K E Y W O R D S
<p>This article examines the role and importance of artificial intelligence technologies in solving mechanics problems using modeling methods. Modern approaches problems using machine learning, neural networks, and computer simulation are analyzed. The formation of practical skills among students the integration of artificial intelligence into the educational process, as well as the modeling of complex dynamic systems, are discussed. The research results demonstrate the positive impact of artificial intelligence on mechanics education.</p>	<p>Theoretical mechanics, artificial intelligence, modeling, machine learning, neural networks, computer simulation, engineering education.</p>

INTRODUCTION

The development of modern technologies is bringing about revolutionary changes in the field of education. In particular, when mechanics is combined with technologies, which are the foundation of classical physics, completely new opportunities are opening up. In traditional teaching methodologies, solving problems in mechanics was carried out through time-consuming mathematical calculations and limited graphical tools. Today, with the help of modern technologies, complex mechanical systems can be modeled, visualized and analyzed in real time.

This is fundamentally changing both the educational process of students and the practical activities of researchers. The purpose of this article is to comprehensively assess the possibilities, advantages and prospects of solving problems in mechanics by modeling.

Mechanics and Modeling:

Traditional Approach The science of mechanics includes the following main sections: statics (equilibrium problems), kinematics (geometric description of motion) and dynamics (motion under the influence of forces). Each section requires its own mathematical apparatus - differential equations, variational calculus, matrix methods, etc.

The traditional method of solving problems consists of the following steps:

Constructing a free-body diagram of the body and determining the forces;

Formulating differential equations of motion;
 Setting initial and boundary conditions;
 Solving the equation analytically or numerically;
 Physical interpretation of the results.

This process can often be performed manually in limited cases - that is, within simplified models. However, real problems are difficult to solve by traditional methods due to multivariate, nonlinearity and complex boundary conditions. This is where artificial intelligence technologies show their power.

Application of modern technologies to mechanics

1. **Physics-Informed Neural Networks (PINNs)** This technology directly introduces physical laws — Newton's laws, Lagrange's and Hamilton's equations — into the learning process of a neural network. As a result, the network learns not only from data, but also from the fundamental laws of physics. This allows achieving high accuracy with a small amount of training data, determining unknown forces and parameters as an inverse problem, and predicting the long-term behavior of complex nonlinear systems.

2. **Computer simulation and digital twins** "Digital Twin" technology creates a virtual copy of a real mechanical system. Using ZT, this virtual model receives information from sensors in real time and predicts the current state and future behavior of the system.

3. **The importance of artificial intelligence in the educational process** The integration of modern technologies in theoretical mechanics education is being carried out in several important areas:

- **Interactive problem-solving environments.** Using MATLAB Simscape, Ansys, COMSOL Multiphysics and Python-based libraries (SciPy, PyDy, Sympy-mechanics), students can visually solve complex mechanical problems step by step. AI-assistants identify student errors in real time, provide explanations and recommend the next step.

- **Adaptive learning systems** Modern LMS (Learning Management Systems) platforms use modern technology algorithms to analyze the level of mastery of each student and form an individual learning path for him. It determines in which section of mechanics there is a problem and provides additional exercises and explanations accordingly.

The table below shows the application of artificial intelligence in various branches of mechanics:

Mechanical Department	Issue type	AI tool
Statics	Balance of trusses and structures	FEM (Finite Element Method), Ansys
Kinematics	Analysis of the movement of mechanisms	MATLAB Simscape, Adams MSC
Dynamics	Nonlinear oscillations and resonance	PINN, Runge-Kutta + ML

4. Problems and limitations

Data Shortage: For some complex mechanical systems, it is difficult and expensive to collect sufficient training data.

Computational Resources: Large-scale modeling requires powerful computing platforms.

Pedagogical Imbalance: There is a risk that students will over-rely on modern technology tools and avoid mastering basic mathematical concepts.

Proposals and recommendations. In the future, further deepening of the integration of modern technologies and mechanics is expected. In particular, algorithms of modern technologies combined with quantum computing methods will allow solving currently unsolvable mechanical problems.

Several recommendations are important in this direction:

- Integration of modern technological tools into theoretical mechanics curricula in higher educational institutions;
- Strengthening the teaching of Python, MATLAB and other modeling environments in physics education;
- Systematic retraining of teachers in the use of modern technologies.

Conclusion. Modern technologies are bringing about fundamental changes in the field of modeling and solving problems in mechanics. Neural networks, reinforcement learning methods, and digital twin technologies are making it possible to solve complex physics problems with previously impossible speed and accuracy. In the field of education, modern technologies are creating an interactive, adaptive, and visual learning environment for students, making mechanics a more interesting and understandable subject. However, the rational use of these technologies must be balanced with the independent mastery of fundamental mechanical concepts by students. Modern technologies should serve as a tool, not a substitute for knowledge. By maintaining this balance, modern technologies will become an important factor in raising physics education and practice to a new level.

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