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MATHEMATICAL MODELING AND COMPUTATIONAL EXPERIMENTS

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Abstract: Modeling, especially mathematical modeling, is of great importance in scientific research. In particular, if economic issues are considered, it is necessary to create a mathematical model of the process for regression-correlation analysis. For this, it is necessary to know the stages of mathematical modeling.

The issue of linear programming, which is an element of mathematical modeling, arose first of all in economic issues, in the search for optimal methods of resource distribution and their use.

Therefore, it is difficult to implement algorithms for solving them without modern computing techniques. One of the important areas of application of information technologies in the educational process is the creation of electronic educational literature, manuals, and courses. The creation of electronic educational literature and manuals, and their use in the educational process requires the creation of electronic libraries in educational institutions.

It is clear from this that the emergence of libraries with a single catalog system in educational institutions and the creation of a local network will not only solve problems related to libraries but will also allow to increase the efficiency and coordination of their activities.

Keywords: Mathematical modeling, technical systems, mathematical form, differential equations, hydroaerodynamics.

Introduction. One of the requirements imposed in education is the use of new modern computer technologies in teaching. The fertile use of computer programs in explaining particularly complex algorithms to students is a duty of the era [1].

The introduction of modern information technologies into the educational system, in addition to its economic effect, opens up wide opportunities for hand-to-hand new teaching methods in the educational process. The use of Information Technology in the educational system is mainly associated with the creation of pedagogical software tools for personal computers and Information Technology. When it comes to Computer Technology, Information Technology is usually embodied in our eyes. This is because the invention of personal Composites has led to the popularization of Information Technology and its large-scale implementation. As a result of the emergence of personal computers, the need for software tools, which are the product of information technology, is increasing and becoming a daily need. One of the important achievements in the implementation and implementation of a personal computer is the creation of multimedia tools. Personal computers paved the way for the widespread use of multimedia tools, namely sound, graphics, animation, and video tools. In the educational system, opportunities for organizing the educational process with the help of multimedia tools of Information Technology began to appear. Among these, it is possible to include virtual library, virtual media, search technologies

The main part. Currently, a new methodology of scientific research is based on mathematical modeling and calculation experience. The essence of this methodology is that the current object is replaced by its mathematical model, and mathematical models are studied using

modern computing tools. The methodology of mathematical modeling is developing rapidly, starting from the development and management of large technical systems, and covering the fields of analyzing complex economic and social processes. The wide use of mathematical methods allows us to increase the general level of theoretical research and to bring them into close contact with experimental research. Mathematical modeling can be considered as a new way of understanding, building, and designing, which incorporates many achievements of theory and experience. In the first stage of the calculation experience, the important properties of the object - the laws specific to its structural properties are reflected in a mathematical form. Working not with the object itself, but with its model allows you to quickly and inexpensively study its behavior in existing situations.

At the moment, computational (computer, simulation) experiments on models of objects are studied more fully and more deeply than the theoretical approach, relying on the power of modern computing methods and technical tools of informatics. Technical, ecological, economic and other systems studied by modern science cannot be studied (in the necessary completeness and accuracy) by simple theoretical methods. The emergence and improvement of the mathematical modeling methodology coincided with the end of the 40s and the beginning of the 50s of the 20th century, and it was caused by two factors. The advent of computers was the first, but not the main, factor. The essence of this methodology is that the current object is replaced by its mathematical model, and mathematical models are studied using modern computing tools. Because their appearance freed the researchers from the huge calculation work. The basis of mathematical modeling is the trinity "model-algorithm-program" (Fig. 1). The mathematical models of the studied processes are complex and include a system of nonlinear functional-differential equations.

The core of the mathematical model is made up of differential equations.

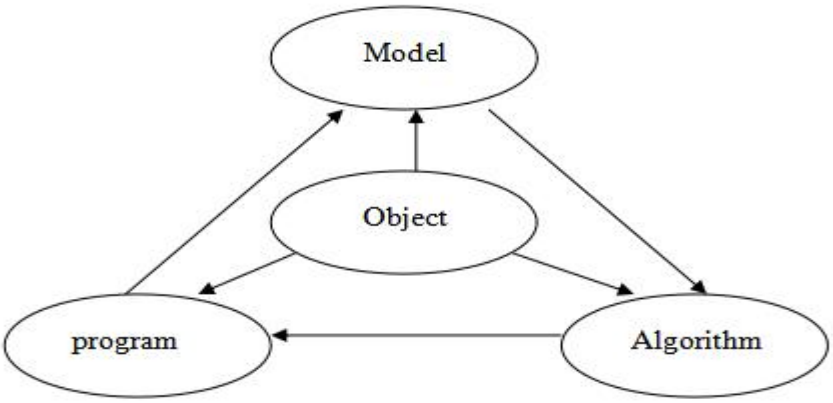

Figure 1. The intellectual core of mathematical modeling

The mathematical model (its main parts) is studied using traditional analytical tools of applied mathematics to find out current information about the object.

The second stage is related to the selection (or development) of the computational algorithm for developing the model on a computer. It is necessary to obtain the required quantities with the accuracy given by the existing computing technique. Calculation algorithms should not limit the main characteristics of the model, the direct object, and should adapt to the characteristics of the

solved problems and calculation tools. The basis of mathematical models is studied with the help of computational mathematics, consisting of numerical methods of solving boundary problems of special derivative equations of mathematical physics. In the third stage, a software tool is created to use the model and algorithm on a computer. The software product should take into account the important feature of mathematical modeling related to the use of a number of mathematical models and the multivariate calculation. As a result, a set of practical programs and packages produced on the basis of object-oriented programming are widely used. It provides an in-depth analysis of all the main layers of the factor calculation experience of mathematical modeling. Relying on the "model-algorithm-program" triad, the researcher gets a perfectly flexible and inexpensive tool, which is first tested.

After that, mathematical models are extensively analyzed to obtain the necessary qualitative and quantitative characteristics and descriptions of the studied object.

Here, the main approaches aimed at the construction and analysis of mathematical models common to various fields of science, which do not depend on a specific feature, are described.

The universe that surrounds people is one. In particular, this is manifested in the perfection of mathematical models, the uniformity of mathematical devices used to describe various phenomena and objects. The general features of theoretical and practical computational experience in scientific research are shown. Below is a brief description of the different types of computing experience. Computational expertise has emerged from the use of computers and numerical methods to study mathematical models. It is considered the highest level of mathematical modeling.

At the empirical stage of science development, observed phenomena are described, experiments are conducted, and experimental data are collected and grouped.

It is characteristic of the theoretical stage to introduce basic laws, new abstractions, and idealization concepts that form its core. In this, a general idea of the studied object is formed, and a description of the general set of experimental data is given. The heuristic value of the theory is manifested in the ability to tell new, previously unknown descriptions of the object, event, or process. The history of the development of science has vivid examples of the discovery of Neptune and Positron. Mathematical ideas and methods serve not only as mathematical ornaments but also as important tools for quantitative and qualitative analysis. Different disciplines have different degrees of mathematization.

A low degree of mathematization is characteristic of subjects where qualitative mathematical models are of primary importance. The degree of mathematization can be described according to what mathematical models are used. For example, the application of mathematics in mechanics is based on the use of a system of partial differential equations. In particular, such mathematical models are used not only in one case but in all departments, such as the theory of elasticity of mechanics, and hydro aerodynamics. The degree of mathematization is also high in physics, but it is still used to varying degrees in its different departments. Currently, the degree of mathematization is increasing in chemistry. For example, chemical kinetics is based on simple differential equations, chemical hydrodynamics is based on partial differential equations. The level of mathematization is also increasing in biology. As proof of this, it is enough to pay attention to Voltaire's classic work on mathematical modeling of the "predator-prey" system, which was carried out at the beginning of the 20th century. We are witnessing the rapid introduction of mathematical ideas into economics, history, and other social sciences. Due

to the accumulated experience in the mathematization of mechanics and physics and the level of development of mathematics, the process of mathematization of other sciences is happening very quickly. The application of mathematics in chemistry and biology is based more on previously developed mathematical apparatus. Therefore, the speed of mathematization of these sciences depends on the level of development of chemistry and biology.

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