



MATHEMATICAL MODELING: INITIAL CONCEPTS, ITS STAGES AND REQUIREMENTS APPLICABLE TO HIM

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Annotation

Mathematical modeling provides an opportunity to solve many problematic situations and issues in the field of human life and activity. From this point of view, it is important to pay attention to its initial concepts, main stages and requirements when studying mathematical modeling.

Keywords: object, model, mathematical model, generality, compatibility, accuracy, efficiency.

Introduction:

Any problem can be solved in several different ways. If the natural process in the problem under consideration can be represented with sufficient accuracy using mathematical approximation, then this problem can be effectively solved by creating and using a mathematical model.

An object or phenomenon is a part of existence that belongs to a studied area, and it has various properties and characteristics of its own. Studying an object or phenomenon is a complex process that is carried out in various ways. The main task of all industry specialists is to fully study the properties of objects related to their field and organize their work and conduct their activities based on this knowledge.

Mathematical modeling of the object is a mathematical representation of the properties and characteristics of the object being studied.

Mathematical modeling provides an opportunity to solve many problematic situations and issues in the field of human life and activity.

Mathematical model is a mathematical expression of objects and phenomena of material existence. The main purpose of creating a model is to study objects and phenomena and to try to predict the results of experiments conducted on them. Mathematical models are useful in the study of objects and processes and in the verification of assumptions related to them, especially when it is not possible to directly use real objects.

Before talking about mathematical modeling, let's think about what the modeling process means in general. In general, modeling is an in-depth study of certain objects or phenomena, as we understand them, by creating and researching their models. During the study of any phenomena that are large in scope and complex in terms of understanding, they are made to look simpler in order to facilitate the calculation work carried out on them.

The main step in the process of creating and studying any system project is to create its mathematical model.



The main stages of mathematical modeling:

- Creating a model. At this stage, specific features of the object, event, and the relationship between them are determined and these features are expressed in mathematical language.
- Problem solving. Solving the mathematical problem represented by the created model. For this, computers and numerous methods of solving problems are used.
- Analysis of results. Analyze the results of problem solving and transfer them from the mathematical language to the language of the research field.
- Model validation. Pay attention to the correct organization of the creation of the model. At this stage, how well the experimental results match the assumptions and conclusions made in the creation of the model, and the accuracy levels of the results are checked.
- Making changes to the model. At this stage, the model is either complicated to increase the accuracy of the experimental results, or the model is simplified in order to simplify the calculation process.

Mathematical models are divided into several types, including structural and functional types.

Mathematical models representing the parts of an object and the interrelation between them are called structural models.

Mathematical models representing processes occurring in objects and events are called functional models.

Classification of mathematical models.

There are many different classifications of mathematical modeling, the most basic of which is the division of models into discrete variable and random variable categories.

If the quantities representing the object or phenomena under study have a one-value correspondence with each other, then the models created on the basis of such quantities are called exact variable models. But in many cases, objects and phenomena are complex, and the quantities that make up them are randomly variable, and appear in an inconvenient way to express them more simply. In such cases, the complex phenomena being studied are subjected to the necessary preliminary study and analysis processes, and a mathematical model is created by the researcher using the elements of mathematical statistics and probability theory. Thus, random variable models are models that assume the studied quantities and random relationships between them.

Therefore, a mathematical model is a way to see an object, an event from a mathematical point of view for a more accurate, complete and deeper understanding, to express the conditions of the studied situation more simply in mathematical language. A mathematical model is in the form of an equation or an inequality, and a complex problem given verbally is expressed through mathematical symbols.

There are different requirements for creating mathematical models. We list them below:

- Generality is the most important requirement. Here, the main focus is to reflect as many of the characteristics of the object being studied as possible in the model being created.
- Compatibility. Here, the main focus is on matching all the characteristics of the object under study with the model and the degree of completeness of this matching.



- Clarity. The degree of accuracy between the quantitative values of the necessary properties of the studied object and the quantities that make up the model is required.
- Efficiency. At this point, it should be assumed that creating a model of the object of attention, studying it, obtaining results in the appropriate order, and applying the obtained results will eventually allow use in theoretical or practical fields.

As examples of problems that can be solved using mathematical modeling, we can cite the following problems:

- Through mathematical modeling of investment attraction, it is possible to improve the efficiency of investment activities, taking into account the amount of financial capital being invested, the main directions of the project, planning the expected income and other economic indicators.
- Through the mathematical model of state economy management, it is possible to effectively manage the economy, taking into account the level of correlation with the country's gross domestic product and inflation, employment and other important factors of the economy.
- It is possible to increase the efficiency of providing the population with mortgage and consumer loans with the help of activities of banks and other participants of the financial market in order to increase the welfare of the population through mathematical modeling of the income level of the population.

Although the sample problems considered are mainly related to the economic field, mathematical modeling is not limited to this field. Mathematical modeling has now entered not only natural sciences such as technology, physics, chemistry, and biology, but also social sciences such as psychology, sociology, and political science.

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