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Existing research approaches to definition “model” and essence of modeling process

In the given work approaches to definition of model, an origin of the given term are investigated, classification of models is given. Also in work the basic methods and principles of modeling, the technology of the given process and its essence are shown.

The term "model" was introduced by G.Lejbnits, the philosopher, mathematician and physicist. The term "model" is originated from a Latin word "modulus", i.e. a sample, the device, the standard. In a wide meaning it is any analogue (imagined, conditional: the image, the description, the circuit, the drawing …) which is used as its "substitute". This term can also be applied to a designation of system of postulates, the data and proofs, the formal description of some phenomenon or a condition of things. Webster dictionary determines “model” as «the simplified description of the complex phenomenon or process ". Making up a model is an art, creativity. The ancients told: «If two looking at the same, it does not mean, that both see the same ". And words of ancient Greeks are: «If two do the same, it does not mean, that it will turn out the same ". These words, in my opinion, relate closely to making up mathematical models. Models can be classified according to different criteria (picture 1).

One of the first, rather full classifications of models was offered by J.Forrester in 1961. Depending on the means used for construction (creation) "models" the latter are divided on descriptive, mathematical, physical and combined (for example, physical and mathematical models). Static and dynamic models (including cybernetic models) are also distinguished. Taking into account, that modeling is a method of reality learning it is possible tell that the basic attribute of its classification is a way of submission of model. During modeling various abstract designs are possible, but the basic one is virtual model which reflects ideal representation of the person about the world around which is fixed in consciousness through ideas and images. It can be representation as evident model by means of graphic images and pictures.

Evident models depending on a way of realization can be divided into two or three-dimensional graphic, animation and 3D. Graphic and animation models are widely used for displaying of processes which occur in modeled system. Graphic models are applied the systems of the automated designing. For display of three-dimensional models with the help of the computer there are many graphic packages. Graphic models are the base of all computer games, and also are applied during imitating modeling to animation.

To construct model in a formal kind, one must create symbolical or linguistic model which would correspond to the best level of the abstract description.

The basic kind of abstract model is mathematical one. Mathematical is the abstract model which displays system as mathematical ratio. Unlike abstract, ones real

models exist in a nature and it is possible to experiment them. Real models are such models in which at least one component is a physical copy of a real object. Depending on what parity there are properties of system and model, real models can be divided into natural and prototyping.

Physical models are existing systems or their parts on which researches are carried out. Natural models are completely adequate to real system which enables to receive high accuracy and reliability of results of modeling.

Prototype models are real models which reproduce system in the certain scale.

According to the possibility change in time the properties of model they are divided into static and dynamic. Static models, unlike dynamic, do not change the properties in time..

Mathematical modeling [mathematical modeling] – is the process of construction and research in dynamics (changes) of behavior of mathematical models of various processes, the phenomena and physical objects with using the means of computer facilities. In a basis of mathematical modeling are fundamental laws of natural sciences and the exact sciences connected with the purposes and subjects of modeling. On the basis of these laws the mathematical device describing the researched phenomena and objects which are transformed to the appropriate algorithm and the program for its realization on the computer is developed. Depending on overall aims of the mathematical modeling, "tests" of mathematical model received in a course the data can be used for making certain decisions, in particular, for a choice of alternative variants of behavior of experts or for specification of initial mathematical model (for example, as the amendments entered into the mathematical device, and thus are used as means of its perfection). Methods of mathematical modeling have found the wide in application at construction of so-called intellectual (expert) systems, systems of the automated designing etc.

Kinds of modeling are:

Computer;

Mathematical;

Physical;

Imitating;

Structural;

Basis of modeling is the methodology of the system analysis. It enables to investigate system which is projected or analyzed, according to technology of operational research, including such interconnected stages:

1) Construction of model. At this stage some "nonmathematical" object - a natural phenomenon, a design, the economic plan, production process etc. is set thus, as a rule, the precise description of a situation is complicated. The basic features of the phenomenon and communication (connection) between them at a qualitative level first come to light. Then the found qualitative dependences are formulated in mathematics language that is the mathematical model is under construction.

2) The decision of a mathematical task in which model has the result. At this stage the big attention is given development of algorithms and numerical methods of the decision of a problem(task) on the computer by means of which the result can be found with necessary accuracy and for allowable time.

3) Interpretation of the received consequences from mathematical model. The results received from model in language of mathematics, are interpreted in the language accepted in the given area.

4) Check of adequacy of model. It will be coordinated within the limits of the certain accuracy whether at this stage results of experiment with theoretical investigations from model is found out.

5) Updating model. At this stage there is or complication of model that it was more adequate validity, or its simplification for the achievement of practically acceptable decision.

It is possible to draw conclusions, that mathematical models are applied to the analysis, forecasting and a choice of optimum decisions in various areas of economy. This planning and operative production management, management of a manpower, storekeeping, distribution of resources, a lay-out and accommodation of objects, a management(manual) of the project, distribution of investments etc.

Modeling is the basic method of researches in all fields of knowledge and scientifically proved method of estimations of characteristics of the complex systems, used for making of decisions in various spheres of engineering activity. Existing and projected systems can be effectively investigated with the help of mathematical models (analytical and imitating), sold on modern computers which in this case represent itself as the tool of the experimenter with model of system.

The method of modeling is applied widely in such areas, as automation of designing and the organization in the automated systems of scientific researches, in systems of research and designing, in systems of mass service, with the analysis of the various sides of person activity of the, automated management by industrial and other processes. It is important to emphasize, that modeling is used at designing, creation, introduction, operation of systems, and also at various levels of their studying, beginning from the analysis of work of elements and finishing research of system as a whole at their interaction with an environment.

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