

TECHNOLOGY OF DEVELOPING STUDENTS' CRITICAL THINKING THROUGH BIOLOGICAL PROBLEMS MODELING TECHNOLOGIES IN MEDICAL EDUCATION

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Annotation

This article discusses the ability of medical students to perfectly model computerized processes in the implementation of modern medical procedures, as well as the features of determining the patient's condition caused by the disease.

Keywords

Biological process, model, optimal control, cybernetic system

The study of phenomena and processes, the solution of related issues is carried out by modeling and controlling them on the basis of information technologies. In this sense, it is necessary to have the appropriate knowledge of the concepts of control, optimal control, the concept of communication that allows control, and modeling of physical, biological, economic issues, in particular, data modeling and computer modeling.

Fundamentals of models and modeling.

Elements of control theory. Optimal control.

Visual aids: Presentation of slides on the topic using a projection device and explanation of the topic using a wall stand.

Key words: Model, modeling, control theory, elements, optimal control, feedback, phenomena, processes, issues, social development, natural automated and automatic systems, physical, mathematical, biological, economic and other models, mathematical modeling and its stages, computer modeling and its essence.

Elements of Control Theory

As society develops, the number of controlled objects increases, and control problems become more complex. Complex machines and machines, enterprises and institutions, even the person himself, and society are considered objects of control. Such objects are called complex dynamic



(moving) systems in cybernetics. The study of general laws governing the control of such systems, and the discovery of the key to the secrets of control in human hands, have become one of the most urgent issues today. As a result, the science of control, that is, cybernetics, emerged. "Cybernetics" is a Greek word, and in Uzbek it means "ship", that is, "ship controller". That is why the science of control is now called "cybernetics".

The emergence of modern cybernetics is associated with the name of the American scientist Norbert Wiener (1894-1964). Norbert Wiener came to the conclusion that there are laws of information control in both technical and living systems, and laid the foundation for this science with his book "Cybernetics, or Control and Communication in Living Beings and Machines," published in 1948.

You know the important discoveries in the field of control of living organisms. The laws of mechanics are the basis of the movement of machine mechanisms. So, on the one hand, various systems (nature, national economy, living organisms, machines, mechanisms, etc.) move according to their own laws, that is, each system has its own laws of interaction. The laws specific to each of these systems are studied by independent disciplines such as physics, mathematics, chemistry, biology, medicine, politics, economics. On the other hand, the science of cybernetics undertakes the study of control processes in all systems.

In a society with highly developed productive forces, there was a need to automate not only physical labor, but also brain functions. Because in such a society, the amount of information increases significantly relative to the productive forces. As a result, old methods do not allow for the collection and processing of such a large amount of information. Therefore, in the middle of the 20th century, the science of cybernetics and electronic computers, which are tools for information processing, were born.

Currently, the theoretical foundations of cybernetics are being created and their application in the national economy, science and technology, and education is underway, and electronic computers are being improved every day.

One of the main concepts of cybernetics is information. Without air, a person cannot live, a factory cannot function without energy, and there is no control without information. For control, it is necessary to collect information, transfer it from one place to another through communication channels, and process it. In cybernetics, any information received directly or through devices using the sense organs (ears, eyes, mouth, skin) is considered information.

Cybernetics studies the processes occurring in living nature, society and production and ensures their management in accordance with the developed goals and tasks. One of the distinctive features of cybernetics is that it is based on the generality of the laws underlying the management of processes occurring in various environments, conditions and in various areas of human activity. From the point of view of cybernetics, all processes occur in complex dynamic systems consisting of control objects. No matter how complex the processes occurring in them are, they can be known and they obey clear mathematical and logical laws. Knowledge of the processes occurring in controlled dynamic systems and the laws to which they obey allows us to create technical means of management, control subjects, and control systems. Control subjects - control systems and control objects - complex dynamic systems of various natures together form a control system. Many examples of such control systems can be given. In living nature - blood circulation, digestion; in society - planning, supply, and allocation systems; in industry - individual production processes, enterprise, production network management systems, etc.



Thus, the science of cybernetics deals with complex control systems, and such systems are called cybernetic systems.

The change in the state of cybernetic systems is subject to certain laws, and this law must be studied.

A system can be considered a collection of elements that are directly or indirectly related to each other. Any action taken on any element in the system also affects other elements that are related to it.

The purposeful influence exerted on the elements that make up the system is called system control.

The issue of control arose very anciently and was dealt with by man himself. A person needed to control his own behavior, to perform management tasks in the family. The professions of a tailor, a driver, a pilot all involve work related to the control of machines and mechanisms. At the societal level, man himself is involved in the field of economic activity management.

There are many ways to control a machine, robot, airplane, tape recorder, or nuclear reactor. For example, one action is performed, the result is observed, then another action is performed, and in this order, the actions are performed sequentially until the final result is achieved without interruption. In this order, operators control a nuclear reactor, captains control a ship, pilots control an airplane, and astronauts control a spaceship.

However, in many cases, such control is inconvenient, and in some cases, it is impossible at all: the work to be performed takes place very far from the performer (for example, a person) or in an environment harmful to the human body (for example, nuclear radiation). Human reaction is not enough to perform the work: the procedure for performing the work may continue uniformly and continuously, causing errors, etc. In such cases, it is possible to analyze the situation and plan the sequence of its control in advance.

Cybernetic systems can be divided into the following three classes:

1. **Natural system**—the control device is created by the user (for example, DNA material, the human brain).
2. **Automated system**—part of the control tasks is assigned to the machine, and the conclusion is drawn by a person.
3. **Automatic system**—all control processes are automated.

The task of goal-oriented management is to transfer the system from one state to another - a new state. This transfer can be carried out by spending a lot of time, labor, material or energy,

The object of management, that is, a controlled dynamic system, can include various natural collections, including a collection of living beings, plants. As the main objects of management, a team of people whose activities are aimed at achieving a certain goal can be taken. For example, organizations for the provision of planning, supply, finance, transport, communication, trade services are objects of management.

Optimal control.

When technological processes are controlled only by humans, delays in operation and



excessive consumption of raw materials can occur. In modern production, it is considered natural that a person does not have time to assess the satisfactory or unsatisfactory state of the production process in a timely manner, as well as to measure the necessary parameters - temperature, pressure, etc. with the necessary accuracy.

To get out of this situation, it is necessary to automate the control process, and automation of control leads to an optimal (most acceptable) solution to the problem. The problem will not be solved by giving control to a technical device (robot, computer, etc.). Because no technical device can solve logical problems on its own. It is necessary to enter a program that clearly indicates the actions to be performed into it. Of course, in order for the production process to be accurate, the program commands entered into it must be thought out in all respects. The machine does not understand commands such as "do it better", "melt the steel", "tighten the nut", so the content of these requirements must be clearly indicated. This requires a quantitative theory related to process control. In addition to studying the specific control process, a general control theory is needed, which is based on the same principle in any case.

The need to create such a theory arose in the 1950s. This was due to the rapid development of electronic computers and their introduction into production, transport, medicine, economics and other fields for control.

N. Wiener's study of control problems led to the emergence of cybernetics. R. Bellman and his colleagues conceived the idea of dynamic programming. L.S. Pontryagin and his students created a mathematical theory of optimal process control. In 1939, L.V. Kantorovich expressed the problem of linear programming in mathematical terms.

If the system is transferred from one state to another - a new state, that is, the process is called optimal control, if the least amount of time and labor or the least amount of material and energy is spent during control.

As control objects, a living organism, a living plant (even a single-celled living organism), a group of people, a workshop, a machine shop, factories, production organizations, groups, etc. can be taken.

Although the listed objects have a different nature, their control is carried out according to a single scheme: collecting initial information about the controlled object or its part, entering this information into a single system for later use or storage (classification); studying information for transmission through communication channels; decoding it and, finally, developing control commands and implementing them. Depending on the nature of the problem being solved, such a scheme can also be changed.

Feedback

Man began to apply the principles of feedback very early, even before he understood its mechanism and significance. Let us consider the main conclusions of feedback on the example of a thermostat. A thermostat consists of A - a chamber, B - an electric heater and V - a thermometer. When the current is connected, the device heats the chamber and the temperature in it rises.

The sensor - a thermometer - not only receives information about the temperature, but also serves as a current transmitter. The electric heater operates and heats the chamber until the temperature in the chamber reaches a certain value. After the temperature reaches a predetermined value, the current is turned off. Heating the chamber "by inertia" continues for



some time, then the temperature decreases, the contacts are closed again - the heater is connected to the source, etc.

The arrow lines in the figure show the direction of action. The upper arrow shows the heating of the chamber, and the lower one shows the connection of the electric heater to the source. The diagram depicts a closed circuit. This phenomenon is a feedback loop. The task of the feedback loop here is to maintain a constant temperature in the chamber.

Feedback systems are widely used. The principle of feedback ensures that not only temperature, but also other quantities are maintained at the same rate - the speed of a moving train or airplane, the rotation of a turbine, and so on. For a living organism to live normally, a number of physiological parameters must be within certain limits. The stability of such physiological parameters is also achieved with the help of feedback. Another example of the use of feedback. A telescope moves with the help of a special mechanism in such a way that the star is always in the center of the optical field of the telescope, as if the telescope "follows" a star moving in the sky. In this case, two photocells that receive light from the left and right sides of the center serve as sensors. If the movement of the telescope lags behind the movement of the star in the sky, the effect is shifted below the center of the optical field. This affects the photocell and sends a signal to the electromotor. The telescope movement accelerates. If the telescope moves faster, the image of the star is shifted to the other side of the optical center and affects another photocell. Again, the electromotor receives a corresponding signal and the telescope movement slows down. Thus, the light coming from the star becomes part of a closed feedback loop. This is an example of an external feedback loop.

The external connection of feedback is characteristic of living organisms. When a goalkeeper in a football game tries to catch the ball, his body moves in accordance with the signals of a receiving device or sensor. The sensor is the player's eye that monitors the movement of the ball. The goalkeeper tries to position his body in such a way that the distance between his hands and the ball is as small as possible. Since the player's body has inertia, the body's movement does not always coincide with the direction in which the ball is coming. Nerve centers in the brain send signals to the muscles that correct the deviation of the body from the required trajectory.

Model and its types

A model (lat. modulus - measure, standard) is an image or sample of an object or system of objects.

For example, a model of the Earth is a globe, a model of the sky and stars on it is a planetarium screen, a photo in a passport can be called a model of the owner of this passport.

Humanity has long been interested in the problems of creating comfortable living conditions and predicting natural disasters. Therefore, it is natural for humanity to study various phenomena of the outside world.

Experts in the field of exact sciences study only those features of a particular process that interest them. For example, geologists study the history of the development of the Earth, that is, when, where and what animals lived, plants grew, how the climate changed. This helps them find mineral deposits. But they do not study the history of the development of human society on Earth - this is done by historians.

As a result of studying the world around us, inaccurate and incomplete information can be obtained. But this does not prevent us from flying into space, unraveling the secrets of the atomic



nucleus, mastering the laws of the development of society, and so on. On their basis, a model of the phenomenon and process being studied is created. The model should reflect their features as fully as possible.

The approximate nature of the model can manifest itself in various ways. For example, the accuracy of the instruments used during the experiment affects the accuracy of the resulting result.

Modeling is the study of objects of knowledge (physical phenomena and processes) using their models, the creation and study of models of existing objects and phenomena.

The modeling method is widely used in modern science. It facilitates the process of scientific research, and in some cases becomes the only means of studying complex objects. Modeling is of great importance in studying abstract objects, remote objects, and very small objects. The modeling method is also used in physics, astronomy, biology, and economics to determine only certain properties and relationships of an object.

Depending on the means of selecting models, it can be divided into three groups.

There are such groups as abstract, physical and biological.

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