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AUTOMATIC CONTROL IN BIOTECHNICAL SYSTEMS

Eshonov Ravshanbek Muxammadmusayevich

Annotation: this article carried out scientific research on automatic control in bioengineering systems.

Keywords: control, automatic, bioengineering, system, learning, health, AI.

Introduction. Automatic control theory is a branch of technical cybernetics that conducts scientific research on the creation of automatic control systems (ABTS) of various complexity and different processes in the character. Theory of Automatic Control n.at real objects are replaced by their similar (adequate) mathematical models. It deals primarily with two problems: ABT analysis and synthesis. Two types of control systems, namely open and closed control systems, differ from each other in the methods of process control. In the first, the controlling effects are aimed at reducing the difference in their saturation, depending on the effects that saturate the process. The main disadvantage of such a control system is that it cannot eliminate the effect of external damping that cannot be measured. In addition, these control systems cannot control unstable objects for a long time. On the floor of closed control systems lies the idea of feedback. This idea is based on the principle of deviation control (orfeedback control). Here, due to the deviation of control parameters from the required level, executive signals are formed that return them to the desired state. The universality of such a method is manifested in the control of unstable objects. In the theory of automatic control, specifically in the theory of closed systems, the central problem is the stability of the system. The 50s and 60s of the 20th century was a period of rapid development of methods for synthesizing such systems. The choice of a quality criterion plays a key role in solving the issue of synthesis. Among the methods of synthesis of ABT, invariant and autonomous synthesis methods of such systems occupy a special place. In this theory, the ABT synthesis method, based on the use of an integral quality assessment criterion, is a priority. As expressed in the theory of automatic control, the problem of optimal control synthesis of nonlinear objects with a limit in the form of control inequality, Pontryagin's maximal law, Bellman's dynamical applications are partially applied in solving new problems of volatility calculus. encouraged the emergence of modified methods. Methods for synthesizing acceptable systems are generalized, and the theory of automatic control is n. Relatively little research has been done in the class of distributed parameter management systems. In some control objects, the aprior of an excitable mathematical model is not (not adequate) ABT or the actual state of the object in the process of designing it. Due to the extreme complexity of the process that often occurs, a control object based on certain physical or chemical laws can be it is almost impossible to create a mathematical model. This is, of course, the result of external and internal feeding parameters that cannot be measured when using ABT, change their readings. For this reason, a scientific direction appeared, which is called methods for determining control objects. The emergence of flexible control systems allowed a priori to fill the lack of data and led to an increase in system efficiency. A simple closed Extreme Tuning System belonging to the class of flexible control systems can be classified into a separate class, and such control is a probabilistic issue. To solve it, Statistical solution methods and controlled random process theory are used. At the stage of scientific and practical research on the creation of ABT, methods of continuous (analog) and continuous (digital) modeling are of great importance.

In bioengineering systems, automatic control involves the use of feedback and redirection mechanisms to regulate biological processes, as well as various control algorithms and sensor technologies. Find out the importance of automatic control in increasing efficiency and productivity in different areas.

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Principles of automatic control
Feedback and feedback control - understand the basic concepts of feedback and feedback control and their application in bioengineering systems to ensure correct and accurate regulation.
Control algorithms and techniques - learn about various control algorithms and methods used in Automatic control, such as proportional-integral-Latin (PID) control, predictive model control, and adaptive control.
Sensor and actuator technologies-explore advances in sensor and actuator technologies that allow real-time monitoring and control of biotechnical systems that provide optimal performance and security.
Applications of automatic control
Bioprocess management in the pharmaceutical industry - optimize bioprocesses for pharmaceutical production, find out how important automatic control is in ensuring stable product quality and yield.
Environmental Control in agriculture-find out how automatic control systems contribute to effective environmental control in agriculture, which allows precise irrigation, nutrient management and climate regulation.
Patient monitoring and control in health care - learn how automatic management plays an important role in patient monitoring systems, ensuring the correct and timely delivery of health measures.
Difficulties and limitations
Consider the complexity of biological processes - the complexities inherent in bioengineering systems and what difficulties they pose when developing effective automatic control strategies.
Uncertainty and volatility - learn about uncertainties and volatility in Biotechnical systems and the strategies used to solve these problems in automatic control systems.
Ethical considerations-explore ethical aspects in ensuring responsible and safe practices in the design and implementation of automatic control systems in bioengineering applications.
Advances in Automatic Control Technologies
Machine learning and artificial intelligence – learn how machine learning and artificial intelligence revolutionize automatic control by activating flexible and self-learning control systems.
Understand the benefits of a predictive management model that uses model - based predictions to optimize model predictive management decisions and improve system performance.
Integration with" Data Analytics " - explore the integration of automatic control systems with data analysis using big data to improve system understanding and optimize management strategies.
Future prospects for automatic control
Potential for Personalized Medicine-individualized treatment plans and therapies open up an automatic management potential in personalized medicine that can be dynamically adjusted for the patient's optimal results.
Increase sustainability in biotechnology-learn how automatic control systems contribute to biotechnology sustainability by optimizing resource use, reducing waste, and promoting environmentally friendly practices.
Integration with Internet of Things (IoT) and cloud computing - explore the synergistic integration of automatic control systems with IoT and cloud computing, allowing remote monitoring, data storage and real-time decision-making.
Conclusion. Automatic control is an important component of bioengineering systems, making it possible to accurately regulate, improve efficiency and improve the quality of products. With the development of technology, the integration of AI, machine learning and IoT opens up new opportunities and revolutionizes the field of automatic control in bioengineering systems.

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