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AUTOMATED CONTROL SYSTEMS AND AUTOMATIC CONTROL THEORY

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Анотація: *автоматизована система управління призначена для автоматизації процесу збору та передачі інформації, її обробки і видачі виконавчих дій на об'єкті управління*

Ключові слова: автоматизована система управління, автоматизація виробництва, теорія автоматичного управління

Abstract: *automated control system is designed to automate the process of collecting and forwarding information, its processing and issuing executive actions on the management object*

Keywords: automated control system, automation of production, automatic control theory

Automated Control System (ACS) is a system that includes integrated use of mathematical, technical, organizational and information tools to manage and control complex (complicated) economic and technical facilities.

ACS covers the whole management system in the company and it is consist of technical tools and technical and economic methods by which the information problem are solved and the company is managed. Most control systems that are currently used in different industries and production are computer-integrated because the main technical tools of such systems are computers and the application of them allows integrating several management functions. Computer integrated control system arise because of the development of the integrated automated control systems. [1]

Automated control system is a system that operates on the basis of modern computer technology for the collection, processing and transmission of management information. It is the control structure combined with the complex of technical equipment, which that integrate with the object of control and the human being. The modern automated control system includes primary shaping devices, devices for automatic extraction and transmission of data and for logic and mathematical data processing, devices for displaying results, devices for generating control functions, and execution devices.

According to the purpose, nature of operation of ACS they are divided into two main types. The first type includes organizational management systems. These systems mean people management and their teams using appropriate technology. The second type of ACS - process control systems.

The goal of automation is to increase productivity, to improve product quality, to optimize management, to remove people from dangerous industries, to improve the reliability and accuracy of production, to increase convertibility and to reduce the time of processing.

There are partial, integrated, and total automation of production.

Partial automation includes automation of control operations. Partial automation means automation of specific production operations. This type of automation is used in those cases where process control is practically inaccessible to human effort because of the complexity or rapidity of the process and where simple automatic devices can effectively replace human labor.

Integrated automation of production is a unified interrelated automated complex. Integrated automation of production covers all the basic functions of the enterprise. It is possible only in the case of highly developed production based on modern technology and sophisticated methods of control using highly reliable production equipment. The human functions are overall monitoring and control of the entire complex. [2]

Total automation of production is the highest stage of automation. It means the transfer of all functions involving control and monitoring of complex automated production to automatic control

systems. Total automation is also used in inaccessible situations or where conditions are hazardous to human health or life.

Automatic control theory (ACT) deals with the design principles of automatic control systems and the rules for the proceses , which are investigated by means of dynamic simulations of the real systems, taking into account the operating conditions, the specific purpose, and the structural features of the controlled object and the automatic devices, so that efficient and accurate control systems can be designed.

The processes in objects are described by systems of ordinary or partial differential equations according to whether the objects have lumped or distributed parameters. The elements of automatic devices are also described by systems of differential equations.

An analysis of a control system establishes the system properties for a given structure. Building up a control algorithm, developing a corresponding system structure which fulfills a specified purpose with the requisite quality control, and determining the parameter values for this system make up the content of the synthesis problem. Before starting to develop a control system it is necessary to have access to some initial data: the properties of the controlled object, the nature of the disturbances acting on it, the objective of the control, and the control accuracy required. A control unit is associated with the object being controlled; the control action is transmitted through the control unit from the control device to the object. The characteristics of the actuating mechanism are determined as soon as the characteristics of the control unit are known. But this disrupts the circuit of the control system's parts whose properties are determined simply by their interaction. In this way the concept of an unalterable part of a control system is introduced; it is unalterable in that its properties are specified prior to constructing a control algorithm and, as a rule, cannot be changed. The specified objective of the control determines the means of control. As a result, a block diagram of the control system is outlined. [3]

Two methods of solving synthesis problems—the analytical method and the method of sequential approximations—are usually used. In the first method either the form of the transfer function of the automatic device or the control algorithm is found, or the values for the parameters of the selected structure of the given device that give the extremum of the quality criterion are established. This method makes it possible to find the optimal solution immediately, but it often leads to complicated and cumbersome calculations. In the second method the transfer function of the automatic device is determined for a specified quality criterion, and then a comparison is made of the specified indexes and the actual values for the resulting system. If the approximation proves acceptable, the design is considered to be finished and the construction of the apparatus can be started. If the approximation is unacceptable, the form of the transfer function is then changed to obtain a variant that meets the specified accuracy requirement.

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