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Automated control systems of technological processes

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ABSTRACT: This article discusses the increase in labor productivity through the automation of technological processes.

KEYWORDS: automated system, highly efficient, integrated, regulation.

I.INTRODUCTION

Increasing labor productivity by technological processes largely depends on the level of comprehensive mechanization and automation of production processes. Significant advances in automation have been made over the past decade. It is characterized by the widespread use of science-based design methods, the use of computer technology, and the transition from the creation of local controlled units to integrated automated systems.

II. METHODOLOGY

Computing is widely used in automated process control systems (APCS). In automated systems, the human operator is not derived from the direct control loop of the object. The process control system is understood as a system implemented on the basis of high-performance computing and control equipment, ensuring the management of a technological object on the basis of centrally processed information according to specified technological and technical-economic criteria, determining quantitative and qualitative results of product development, and preparing information for solving organizational and economic problems.

The scientific and technical level of the process control system is determined by the information-computing and control functions performed by it. Information and computing functions include: collection, primary processing and storage of technical and technological information; indirect measurement of process parameters and the state of technological equipment; signaling on the state of the parameters of the technological process and technological equipment; calculations of technical, economic and operational indicators of the technological process and the operation of technological equipment; preparation of information for higher and related systems and management levels; registration of process parameters, conditions of technological equipment and calculation results; control and registration of deviations of process parameters and equipment conditions from the set; analysis of the operation of technological equipment protection locks; diagnostics and prediction of the process and conditions of technological equipment; diagnostics and forecasting of the state of the complex of technical means of process control systems; prompt display of information and recommendations for the process and management of technological equipment, the implementation of procedures for the automatic exchange of information with superior and related control systems.
The control functions include: regulation of individual parameters of the process; one-stroke logic control (blocking, protection, etc.); cascade control; multiconnected regulation; performance of program and logical operations of discrete process and equipment control; optimal control of steady-state process conditions and equipment operation; optimal control of transient process conditions and equipment operation; optimal control of the technological facility as a whole with adaptation of the control system.

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The functioning of the process control system is ensured by a set of technical facilities, system-wide technical documentation and operational personnel. The complex of technical means consists of a combination of computing and control devices, signal and data transmission devices, signal sensors and actuators that ensure the performance of the specified functions of a specific process control system.

The main groups of technical means are: devices for obtaining information about the mode of the technological process and equipment (physical quantity signal sensors, devices for manual input of signals, etc.), devices for generating signals and maintaining information transmission channels (various signal converters and switches), local automation devices regulators, amplifiers-converters, actuators, etc.), computer equipment (information processing, input and output devices, data transmission, storage, etc.), communication devices with the object (signal switches and tele mechanics), communication devices with operational personnel (indicators, signaling devices, registrars, integrated control panels, control panels, etc.).

III. EXPERIMENTAL RESULTS

The structure of the system-wide technical documentation includes the mathematical support of the process control system (MS control system) and organizational support. The software for automated organizational management systems is understood as a complex of circuit, software and language tools that provide: effective management of computational processes, optimal organization of problem solving, data reception, output of the results and information exchange between system links (machines, autonomous devices and users); performance of the functions of control, protection and adjustment of data, monitoring the operation of computer technology, fault detection; automation of the processes of algorithmization, programming, solution of control problems, debugging and adjustment of programs. The solution of problems in such systems is characterized by close informational interconnection with the control object, which determines the special conditions for the receipt and use of data, high requirements for data accuracy, the need for long-term storage, etc. The main functional tasks of automated organizational management systems (OMS) are solved in real time, are limited by certain periods and the duration of their solution, which requires in some cases the functioning of the computer in multiprogram mode, especially in the time sharing mode, significantly complicating the mathematical support (MS) of the system. The automated process control system is divided into the algorithmic one, including a description of the algorithms for the implementation of individual functions and a general algorithm for the functioning of the process control system, and software. Software (software), in turn, is divided into standard software (software) and functional, or application software (software).

Standard software (STS), as a rule, comes with computer systems and includes organizing, dispatching, broadcasting, editing, diagnosing and other programs. Application software (software) is developed individually for a specific process control system. Organizational support (OS) determines the actions of the operating personnel and, first of all, the technologist-operator, which is the central link of the automated system. In the field of systemic technical support of process control systems, the main directions are the further development of methods for integrating the technical base, the development of system capabilities (ensuring the layout of systems with full redundancy at the level of the aggregate module, ensuring automatic reconfiguration of the system if one of the modules fails, etc.), improving operational characteristics (development of a monitoring and diagnostic system, automatic restoration of system performance in case of failures, ensuring the centralized launch of multi-machine systems, etc.), the creation of small-sized external memory devices on magnetic disks with fixed and movable heads. The development of communication devices with an object is carried out in the direction of reducing dimensions and cost, increasing reliability, noise immunity, accuracy, speed, expanding the functional range of existing devices, including taking into account the possibility of building dispersed systems.

It is important to ensure a systematic approach to the design of process control systems and, first of all, to develop a functional-algorithmic structure and to formulate individual tasks of an automatic control system, when integrating the structures of a control computer complex (CCC), i.e., when forming a technical base, as well as when developing flexible software . It should be remembered that software is an essential component of the process control system, and the share of its costs in the total cost of creating a system is constantly growing from year to year. This is due to a decrease in the cost of the used technical means, with the development of the functions of an automatic process control system and a corresponding increase in the volume and complexity of mathematical software. The reduction of labor costs and time for the preparation of mathematical support (MS) for process control systems is currently being carried out in several areas by

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developing standard mathematical support (MS) for the main units and technological processes, specialized problem-oriented languages and corresponding translators, which simplify and speed up the preparation and debugging software and automated programming systems that allow the generation and debugging of automated process control system software in interactive mode.

In the process of creating complex complexes of control programs for automated control systems, the design technology has significant significance, which determines the quality, laboriousness and duration of development. When developing control programs, labor efficiency can be significantly improved by introducing structural rules elements and the system as a whole. This circumstance led many experts to the idea of an orderly modular construction of complex program complexes, which is reflected in a number of works devoted to modular programming. Moreover, under modular programming is meant the method of constructing complex programs according to the hierarchical principle on the basis of small program blocks, each of which performs a complete logical function and has volume within 500-1000 teams.

Currently, the need has been established to build a single database for various management systems, which has given impetus to the development of promising approaches to creating data banks. The database is the core of the software system (MS). When generating a database, all the information for each technological parameter necessary for the complete processing of the parameter is entered into it. When working in real time, it receives information from the sensors of the object. After the initial processing, the information can be used in algorithms of the highest levels of the structure of mathematical support (MS) or presented to the dispatcher using the terminals of the control computer complex (CCC). The structure of the database should provide direct access with minimal time and memory, as well as the possibility of correction and replenishment. To do this, it is advisable to use list processing methods, for example, operating with the addresses of quantities, and not with the quantities themselves: the formation of chains of blocks in which each previous block contains the address of the next, etc. The choice of a specific database structure is determined by the set of tasks to be solved and the features used managing computer complex (MCC).

IV. CONCLUSION

A systematic approach to design should be the main core of the automated process control system being created at all stages of development from the technical specifications to implementation. It should cover all the constituent elements of the system: a complex of technical means, a functional-algorithmic structure and mathematical support (MS).

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