

# Digital technologies in questions of automated manufacturing management systems

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**Abstract.** The article states that today in industry 4.0 are widely used automated and computerized control systems of industrial processes of the enterprise. It is stated that one of the types of such systems are MES-systems. The most popular MES-systems are presented, and it is revealed that the use of such systems in the service of the quality of the enterprise will improve the competitiveness of the enterprise. It is specified that the MES-system "FOBOS" is suitable for implementation in departments of quality service of the enterprise, the main advantages and opportunities of this MES-system are described. The article suggested that in order to exclude the possibility of unauthorized access to the MES-system, it is necessary to introduce an information security system. The main ways to ensure the security of data contained in the system are indicated. In conclusion, it is emphasized that the use of optimization and automation of the enterprise is an important step in the context of the transition to industry 4.0.

In the modern world, machine-building production and production systems are dynamically developing and characterized by a mass appearance and a significant acceleration in the dissemination of new ideas and technical solutions. [1] The actual issue facing the modern enterprise is the possibility of the most efficient use of the resources available to the enterprise. Digital production is an integral part of a flexible, competitive and adapted to a real "digital world" enterprise. An organization using digital technologies can take advantage of convergence capabilities, when product data are available at all stages of its life cycle - from design to maintenance and disposal. Automation of activity processes serves the purposes of digital enterprise. [2] The application of modern production management systems of the enterprise improves the efficiency of the organization. This is also true in the context of solving the problem of optimal loading of equipment, including measuring equipment.

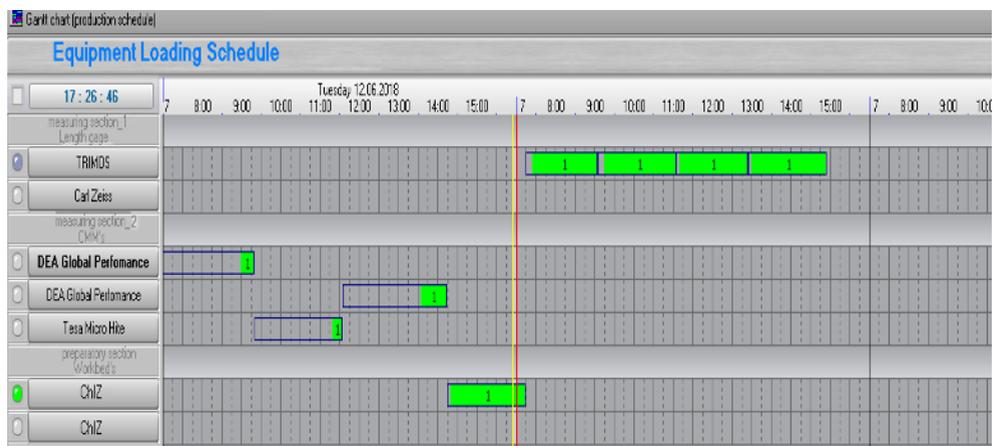
For the most of effective solutions of new and existing problems, automated and computerized control systems of production processes of the enterprise are widely used, as they optimize the loading of control and measuring equipment. [3] Such process control systems as MES (Manufacturing Execution System) systems are widely used. At the moment the most widespread are MES systems Preactor (Siemens), TECHNOCLASS (L-Class), SPRUT OKP (SPRUT Technology), PROefficient (BDE-Engineering GmbH) and

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FOBOS (Institute of design and technology Informatics RAS). For example, Preactor is used in such areas as automotive and aerospace, chemical industry, pharmaceuticals and electronics, food industry, engineering and precision engineering, metalworking, logistics and services. PROefficient is used mainly in the machine building industry, in discrete and prescription industries. However, the aspects of the application of MES-systems for planning the activities of departments of quality service (for example, departments of technical control, metrology, standardization, reliability) are not well studied at the moment. The introduction of that type of systems in the quality service will improve the efficiency of operation and, as a result, the competitiveness of the enterprise.

Domestic MES-system "FOBOS" is suitable for implementation in the activity of quality service departments (Fig. 1).



**Fig. 1.** Gantt chart of the production schedule of the "FOBOS" system.

It allows to calculate the production schedule not only for machines, but also for measuring equipment, also provide calculation of the load of measuring equipment by sections, groups of operations (control of linear, angular dimensions, measurement of deviations from tolerances) within a given time interval and calculates several variants of planned load taking into account overloading or loading of equipment. FOBOS also provides the opportunity to identify a specific product or batch of products to the purpose of their further tracking, accounting to the defects and the calculation of the time necessary for the product to be passed through all stages of the measurement operations. The FOBOS system allows specifying the timing of preventive maintenance of equipment, and takes it into consideration generating production schedules, as well as records events related to unexpected failure of equipment with the ability to specify the estimated downtime. The system has high speed (for example, schedule for 150 pieces of equipment and 3000 manufacturing operations are formed within 5 minutes). It allows considering situations items are not included in one Assembly unit according to the design specifications, at a certain stage of the production process together and should be inspected simultaneously, and then can be disconnected in the process of further processing. It is important FOBOS is a domestic development, which characterizes the degree of adaptation of the system to the modern Russian production realities as high and competitive advantage in terms of import substitution.

When using the MES-system at the enterprises of machine-building and defense-industrial sphere, the product is provided to the Customer at the outlet. At enterprises aimed at fulfilling the state defense orders, the products are monitored and accounted for by the representatives of the military acceptance of the Customer, who must control not only the

quality of the products produced, but also the terms of their delivery. Therefore, it is important to be able to provide access to a certain range of authorized officials to the MES system, and it has the opportunity to receive objective and credible information about the amount of marriage, the means of measuring the product's parameters, the number of fit and not suitable products in the batch and the timing of the completion and completion of control processes in particular and the end of the manufacturing cycle in general. This ensures transparency of production and functioning of the enterprise as a whole at all stages of the life cycle of the product.

However, in order to ensure confidentiality of access to MES information, it is necessary to introduce an access system in accordance with the authority of employees. It is advisable to provide employees who directly measure the parameters of the details, only to the reports, protocols and operations for which their division is responsible. Department chiefs can view and make adjustment to the schedule of their subdivisions, and the chiefs of enterprise services (chief technologist, chief engineer, production manager) can control and compile production schedules of all technological processes. Representatives of military acceptance can have access to the state of technological processes throughout the production, including data on the timing of delivery of orders, the amount of defects and responsible for specific actions.

Providing access to information can be provided in various ways, for example, by using a system of passwords or using personal electronic keys. A personal electronic keys can be stored on a USB device (Fig. 2).



**Fig. 2.** Example of an electronic digital key.

An electronic key is a program code stored on a USB device and an identification program installed on a user's PC. When USB media is connected to the PC access is needed, the program installed on the PC initiates the process of transferring the code from USB storage media, and compares the value of the received code to find the correspondence in its database. If the desired value had been found, the system grants the employee access to the MES information, in accordance with the access rights specified by the administrator. If no matches are found, the system blocks access to information. In this regard, it is important to ensure the security of electronic keys of employees, as with its loss or theft, access to the system can get an attacker.

In order to avoid this, the use of fingerprint identification systems (biometric palm parameters) or, not so often, the retina of the eye, is relevant because these properties are individual for each person. Hardware fingerprint recognition is fair affordable, equipping them with computer users is not a laborious task and does not take a lot of time.

Digitalization of production processes is currently an urgent task. The use of digitalization means allows increasing the efficiency of the functioning of the enterprise by increasing the efficiency of making managerial decisions, the objectivity of monitoring the emerging production environment, increasing the reliability and traceability of production information, and the ability to simulate the processes of enterprise activity [4]. One of the means of digital production, which meets the modern needs of the enterprise, is the MES system. It makes obvious possibility to plan the enterprise's production activities, assess the time and financial costs of the enterprise's technological processes, it makes decisions based on the information received. To protect information from unauthorized access, it is necessary to apply identification and delineation systems of access rights to user information in accordance with their level of competence. The use of optimization tools and automation of the enterprise is an important step towards the transition to fully automated digital production, controlled by intelligent systems in real time in a constant interaction with the external environment, which is characterized as Industry 4.0, where the main role will be played by information in global understanding of the word.

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