EFFICIENCY OF THE USE OF AUTOMATED DESIGN SYSTEMS IN THE MACHINE-BUILDING INDUSTRY

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Introduction. Information technology (IT) is an integral part of human life today. These technologies work based on using a variety of means and methods for collecting, processing, and transmitting data to obtain information of the required quality and the state of an object, process, or phenomenon. The main goal of information technology is the improvement and automation of production processes at the enterprise and the personal needs of a person [Nauka i innovacii,. 2016, 23 – 32]. Information technologies are the leading direction in the professional sphere of a person. Completely new and previously unexplored technologies are being introduced and developed everywhere. In modern enterprises, there is an intensive distribution with the joint improvement of digital and information technologies. This direction for a long time determines the main trajectories of the development of the economy and society and has also led to tremendous changes in people's lives more than once. Information technologies are widely used in modern enterprises and rationalize the work activities of people in the modern world. The introduction of IT in the information sphere of the enterprise and the use of telecommunication means communication has determined a new stage in the development of information technology in the activities of a process engineer. New information technology is an information technology that has a "friendly" user interface, and also uses personal computers and telecommunications facilities [Sborka, 2015, 112 – 116].

Literature review. Over the years, IT has proven its superiority over mechanical human labor. These technologies have a number of advantages, through which the importance of their use in modern enterprises in the activities of a technologist is proved. Information products are the basis for the work of information technology. It is through the information that a system of sequential operations is organized to use the resources and methods of automating various processes. It should be noted that today there are many approaches to the problem of classification of information technologies. Despite its prevalence, the term "information" remains one of the most discussed concepts in science, and the term itself has many different meanings in different areas of human activity. Through information and information technology, confidential data is transmitted, transactions are made at various enterprises, storage and work with classified information are carried out, and so on. This list can be listed endlessly since in the age of

information technology, almost all processes occurring in human life are based on the use of information technology and information in particular [GIAB. 2014. 32-38.]. To date, almost every engineer prefers to work with computer technology to a greater extent. Information technologies make it possible to save modern enterprises from numerous paper drawings and explanatory documentation, which significantly slow down all production processes in the area under consideration. Automation is one of the most relevant areas of scientific and technological progress in various professional areas of the life of a modern person, in particular, mechanical engineering. The term "automation" includes a broad concept that describes all processes performed by specialized software or robots.

Analysis. Thus, through automation, many tasks are performed that do not require human participation. Robotization, on the other hand, is that part of automation, when physical mechanisms are presented to replace people. One of the most relevant and promising areas in the field of automation in the development and integration of intelligent tools that greatly simplify and increase the efficiency of industrial processes [Young scientist, 2016, 65-74]. Artificial intelligence is a disruptive technology with tremendous potential. The introduction of AI in mechanical engineering significantly increases the efficiency of enterprises and companies, as well as their competitiveness with the parallel development of industry markets by stimulating the creation of new technologies. The key technology on which artificial intelligence is based is the ability to "self-learn", as well as the use of accumulated data to predict the future. The main distinguishing feature of AI from conventional digital decisions is that when performing tasks, artificial intelligence is not based on logical schemes previously set by programmers, but independently configures complex decision-making mechanisms, based on the data and tasks that were originally set by programmers. Artificial intelligence today can bring factories to a completely different level of profitability. With it, you can improve any process - from designing a future product to delivering it to the end customer. Moreover, AI today is capable of evaluating the overall performance of an enterprise and suggesting to the manager in which direction to move forward.

Continuing the conversation about the introduction of automated information technologies in mechanical engineering, it is necessary to note the high relevance and efficiency of the integration of computer-aided design systems. Computer-aided design (CAD) systems are also one of the main tools that allow you to automate the execution of drawings through computer graphics. Computer graphics is supported by application software packages, the main purpose of which is to solve, with the help of computer systems, qualification, analytical, economic, and ergonomic problems related in turn to the design activities of machine-building enterprises. CAD is used in almost all scientific and technical fields, examples are automotive, electrical engineering, mechanical engi-

neering, construction, and more. Processes aimed at design automation occupy a key place among information technology and other production systems. CAD hardware is based on the use of resources of electronic computing systems and telecommunication technologies. The mathematical component of computer-aided design systems contains the distinctive features of the mathematical methods used, statistics, as well as programming, and discrete mathematics. Programmable CAD systems are one of the most complex software systems in the modern world, implemented through operating systems of the Windows family, Unix, high-level programming languages C ++, C, Java, and other modern CASE technologies, database management systems, standards of computer systems [Mashinostroenie, 2019, 71-76]. Figure 1 shows the main criteria by which the choice of CAD is classified when planning the implementation of an enterprise about the tasks required for solving:

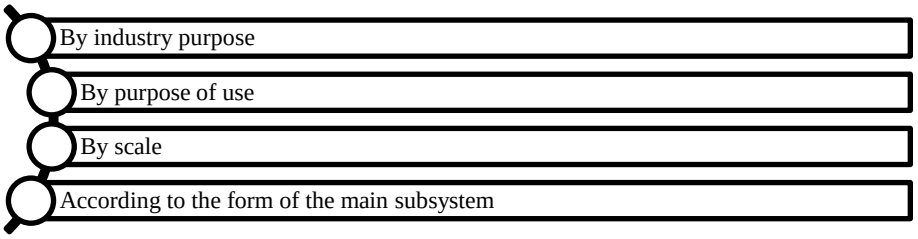

Figure 1. CAD classification criteria

In modern enterprises, to increase work efficiency, almost every development engineer needs to be able to work with CAD software. It is the enterprises that use the technologies of automated production systems that are the main non-competitive objects capable of performing and developing some of the most rational and efficient products [Inter-disciplinary dialogue, 2014, 43-49]. The result of the activities of enterprises using CAD directly depends on how quickly and optimally such systems work. Figure 2 shows the classification according to the purpose of use, repeats components of classic CAD:

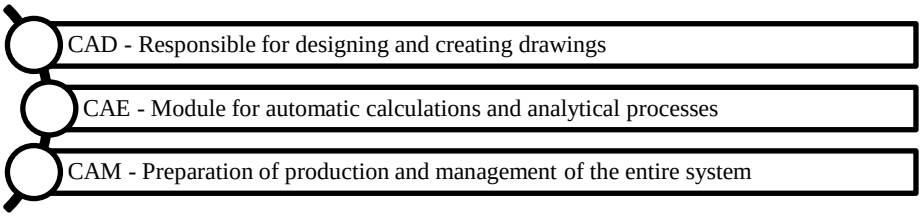

Figure 2. Classification of CAD by purpose of use

To date, the following CAD technologies are widely used and effectively used: ArchiCAD, APM CivilEngineering, K3-Cottage, ProjectSmeta CS, GoogleSketchUp.

The main goal pursued in the development of modern computer-aided design systems is to increase the efficiency of the work of development engineers by providing a more rational interaction with the computer. This factor is achieved through the creation and implementation of an interface that is understandable for any level of engineer,

as well as the introduction of regulatory instructions that optimize familiarity with the software and the subsequent execution of tasks in general [MNIZH, 2014, 32–35]. Thus, to successfully operate enterprises in modern conditions, it is necessary to use advanced information technologies. They allow solving a wide range of tasks in any area due to the complex automation of the main technological and production processes. This became possible through the use of CAD, the productivity of which is increasing every day, and its use is simplified. CAD capabilities help enterprises reduce material costs, energy costs, and time for the production of work, optimize the main production processes, and improve the quality of products. The highest production efficiency is achieved in the case of using integrated design automation systems. Also, one of most effective and most common IT technologies in mechanical engineering is computer mathematical modeling. A mathematical model is a mathematical description of an object, the main purpose of which is its study or management. In the general interpretation, the model is a conditional image of the object of study, developed to simplify this study. When constructing mathematical models, it is assumed that its direct study can provide completely new knowledge about the object being modeled. One of the most effective and innovative technologies used in mathematical modeling at machine-building enterprises is neural networks. A neural network (also called an artificial neural network, ANN, or neural network) is a mathematical model that includes software and hardware implementation. Neural networks are a system that includes simple processors (artificial neurons) combined and interacting with each other. Each of these processors performs exclusively the role of receiving a signal and sending a signal to other processors. Despite such a simple operation algorithm, neural networks that include many processors can perform quite complex tasks [Research and modeling, 2012, 98-104]. It should be noted that ANNs are not programmed, but trained. The possibility of learning is one of the key advantages of neural networks over traditional algorithms for mathematical modeling of various objects. The issue of learning in the technical aspect is to find the coefficients of connections between neurons. During training, ANNs can identify complex dependencies regarding the input and output data of the object and generalize. The consequence of this factor is that, with successful training, the network can return the correct result based on data not present in the original sample, as well as incomplete or distorted data.

In addition to modeling specific objects or parts, computer modeling can be used to solve other applied problems from the field of mechanical engineering related to planning and resource management. In addition to everything that was mentioned earlier, the effectiveness of using mathematical modeling in the study of processes lies in a wide range of problems that can be solved. Such tasks, for example, are tasks of network planning and management; inventory management tasks; tasks of distribution of resources; tasks of planning and placement, and others. The scientific and technical efficiency of CAD applications is determined by the contribution of the application of new approa-

ches and methods to the development of science and technology in general. The social component of efficiency reflects the social and cultural consequences of the introduction of CAD. The economic efficiency of CAD is characterized by a reduction in costs as a result of its use (including the future). As a rule, in works devoted to the evaluation of the economic efficiency of CAD, special attention is paid to the effect of reducing the cost of developing a product design and technology for its production.The greatest effect from the use of computer-aided design systems should be expected with complex automation of all processes for creating documents for products. An accurate assessment of the economic effect of the introduction of CAD meets certain difficulties since it is necessary to take into account earlier entry into the market of new product and its higher competitiveness. In concluding the study of the effectiveness of computer modeling of objects and processes in mechanical engineering, we note the main advantages of using mathematical models indicated in Figure 3:

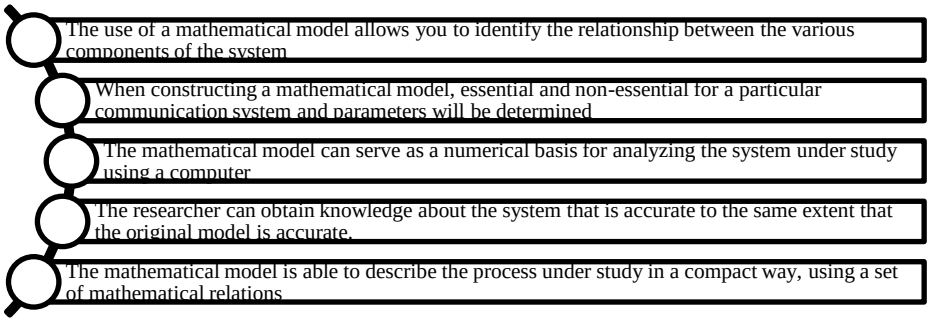

Figure 3. The main advantages of using a computer modeling

Conclusions. Thus, it has been found that information technologies are of great importance in the field of mechanical engineering, allowing modern enterprises to move to a higher quality level. Modern computer tools make it possible to increase the efficiency and quality of processes performed at enterprises through the use of various specialized software and computer mathematical modeling tools. The main purpose of the presented article was to study the issue of integration and use of information technologies in mechanical engineering. The scientific novelty of the work lies in the unique conclusions obtained based on a comprehensive study of the issue of using computer-aided design systems in the engineering industry. The author highlights the main aspects that confirm the effectiveness of the use of these technologies in this industry. The results obtained can be used in further studies by other authors from this field. Also, the scientific novelty lies in the possible assessment of the economic efficiency of CAD integration in enterprises provided by the author. Using the structure of CAD quality indicators presented in the paper, the technology department will be able to develop the most effective measures for the integration and development of innovative technologies from the industry. The work considered individual automation technologies, their clas-

sification, and integration for solving individual problems in the field of mechanical engineering. Also, the work studied in more detail the issue related to the integration of computer modeling tools, which also improves the quality and efficiency of the processses produced at the enterprise and the relevance of using information technologies in the study area as a whole.

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The role of information technologies is being actualized in almost all professional spheres of the life of a modern person. Thus, one of such areas in which information technologies have proven themselves on the positive side, allowing to increase the quality and efficiency of ongoing processes, is the engineering industry. The main purpose of the presented article is to study the issue of integration and use of information technologies in mechanical engineering. The subtasks of this work are: to study the main factors through which the role of information technologies in the modern world is actualized; to study the issue of the relevance of the use of information technologies in the field of mechanical engineering. In the course of completing the work, theoretical research methods are used. To fully disclose the topic and obtain reliable data, the author uses publications and materials from domestic and foreign sources. The main part of the presented article is devoted to the development of the issue of the effectiveness of the use of computer-aided design systems in the field of mechanical engineering. The author reveals in more detail the technical aspects, relevance, and necessity of developing innovative technologies for integration in real production. The paper classifies these tools and provides a list of advantages in their widespread use in various industries.