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TECHNICAL MEANS FOR DESIGN

Abstract. An abstract of the article on technical means of design is provided. The concept and main components of the automated design system (CAD) are disclosed in the article. Advantages of using CAD and ways of further development are given.

Key word: automated design system, industrial product, technical means.

Анотація. Подано статтю про технічні засоби проектування. У статті розкрито поняття та основні компоненти системи автоматизованого проектування (САПР). Наведено переваги використання САПР та шляхи подальшого розвитку.

Ключові слова: система автоматизованого проектування, промисловий виріб, технічний засіб.

Education and science are a strategic resource for socio-economic, cultural and spiritual development of society, improvement of people's well-being, provision of national interests, strengthening of international authority and formation of a positive image of our state. The formation of an innovative model of development in Ukraine dictates new priorities for the system of education and science, requiring its stable dynamism, relentless generation of innovations that would contribute to continuous updating of knowledge [1].

Machine designs are constantly being improved, and their operating conditions are becoming more complicated. Consumer demands for the quality of engineering products are growing. In the 20th century the accuracy of manufacturing some machine elements increased almost 2000 times. Now there is an acute need for production, especially for such specialists. The obsolescence of the modern technological base of science, the irresponsible attitude towards

bringing it into line with modern requirements actually make it impossible to conduct world-level research in Ukraine without the help of foreign partners.

Today, innovative perspectives are associated with the use of information technology (IT), computerization, automation, informatization and the implementation of digital technologies. Ukraine has one of the highest indicators of the human development index, in particular education, which indicates the presence of significant intellectual potential, which forms the basis of the development of innovative activity. However, there is still a gap between science and business practice [3].

One of the directions of the development of science and technology is the solution of the most important problems of physical, mathematical and technical sciences. At the same time, the most prioritized are: systems of automated design, production, use and restoration of machines and equipment; robotic complexes (including with artificial intelligence).

The current stage of socio-political development of Ukraine is characterized by the unprecedented pace of development of a new information and communication organization of scientific and educational activity in society and, as a result, of its development as an informational and civic one. With the advent of computers and computerized means of communication, new information and technological realities of communication appeared [1, 2, 5].

To automate the technological process of product design, the result of which is a set of design and construction documentation sufficient for the manufacture and further operation of the design object, the Automated Design System (SAP or CAD) is intended. It is implemented on the basis of special software, automated data banks, and a wide range of peripheral devices.

CAD technical support includes various technical means (hardware) used to perform automated design, namely computing systems, EOM (computers),

peripheral devices, network equipment, as well as the equipment of some auxiliary systems (for example, measuring ones), which support the design [2, 4, 6].

Design automation occupies a special place among computer information technologies. Automated design software complexes are among the most complex modern software systems based on Unix, Windows operating systems, C, C++, Java and other programming languages, modern CASE technologies, relational and object-oriented database management systems (DBMS), standards of open systems and data exchange in computer environments.

Modern CNC machines are often equipped with automated programming systems. In this case, the machine control system works in multi-program mode, simultaneously providing control of the machine according to the already entered program, and preparation of a new control program. Unsolved scientific and technical tasks related to the automation of the preparation of control programs for CNC machines include ensuring the quality of processing during the preparation of the control program.

Due to their internal properties, interactive CADs ensure the possibility of eliminating errors in the design of products, the production of drawings and the preparation of documentation. With the use of CAD, there are also wider opportunities for controlling the dimensional characteristics of designed products, which are not achievable with manual design. The accuracy of construction of curved surfaces in three-dimensional space, provided by CAD tools, does not bear any comparison with the capabilities of manual methods.

Further development of CAD, according to many developers, should follow the path of creating computer systems that are "loyal" to the user, easily replicated and have the property of development. Some of the most powerful CAD systems are Unigraphics NX from the EDS company, CATIA from the French company Dassault Systemes (which promotes it together with IBM) and Pro/Engineer from RTS (Parametric Technology Corp.).

The main feature of such powerful CADs is large functional capabilities, high productivity and stability of work – all this is the result of long-term development. Most of the computer systems were developed by foreign authors. Therefore, to use them, they use a translation into Russian or learn English. Many people underestimated the digital component in their activities, which is why they were unprepared for active communications in conditions of social distancing.

The organization of production involves the automation of all information processing operations and processes of managing the use of information at all stages of design. The life cycle of industrial products is quite complex and requires a certain amount of theoretical and practical knowledge and skills in using these systems (Fig. 1):
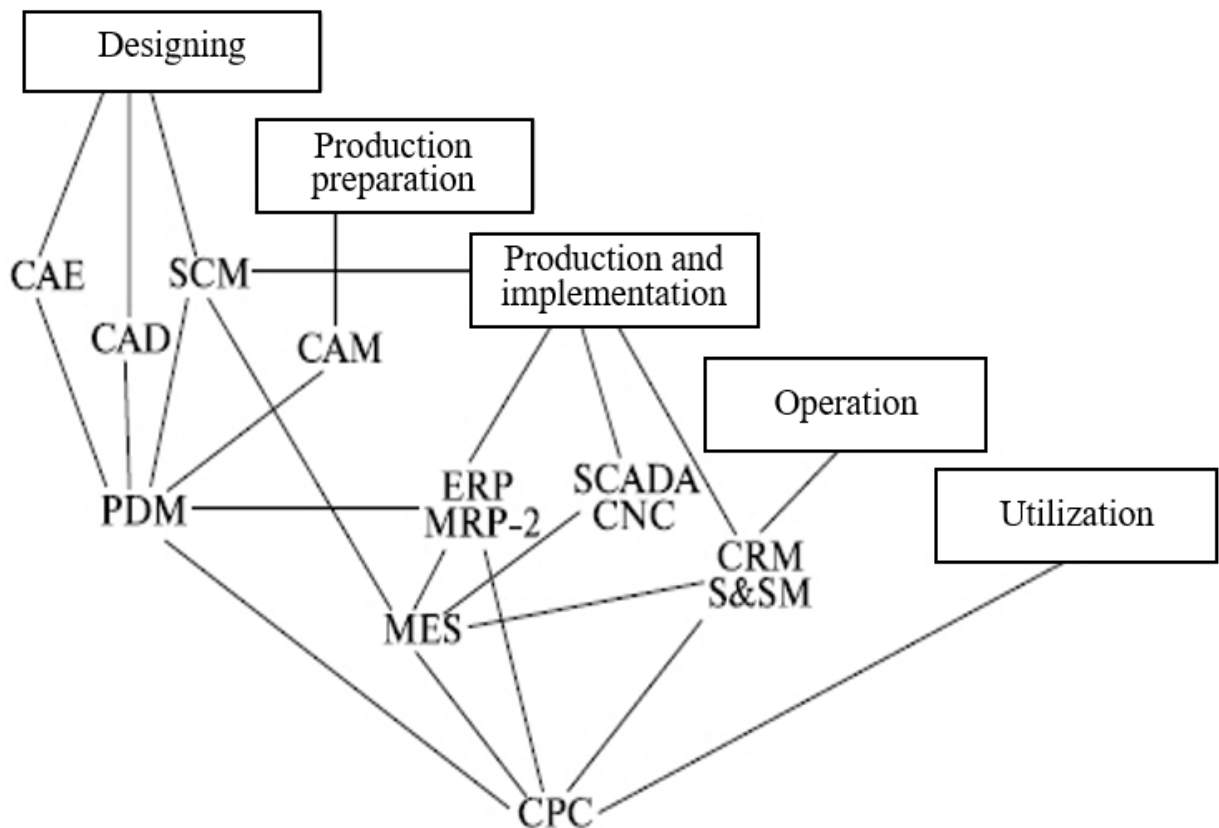

Fig. 1. Life cycle stages of industrial products

- **CAE** (Computer Aided Engineering) - calculation and engineering analysis systems.

- **CAD** (Computer Aided Design) - engineering design systems.

- **CAM** (Computer Aided Manufacturing) - design of technological processes.

- Coordination of the work of **CAE/CAD/CAM** systems is entrusted to the project data management system **PDM** (Product Data Management).

- Supply chain management systems (**SCM**-Supply Chain Management), or the Component Supplier Management (**CSM**) system. The system manages the supply of necessary materials and components.

- **ERP** (Enterprise Resource Planning) enterprise planning and management systems, **MRP-2** (Manufacturing Requirement Planning) production and material requirements planning, **MES** (Manufacturing Execution Systems) executive system, as well as **SCM** and customer relationship management system **CRM** (Customer Requirement Management)

- Marketing tasks sometimes rely on the **S&** Sales and Service Management system, which solves product service problems.

- At the stage of operation, specialized computer systems are also used, engaged in repair, control, diagnostics of operated systems.

- Dispatch functions (collection and processing of data on the state of equipment and implementation of new technological processes) and development of software for embedded equipment in ACS TP - the **SCADA** (Supervisory Control and Data Acquisition) system.

- Software control of technological equipment - **CNC** system (Computer Numerical Control) based on controllers built into the technological equipment (specialized industrial computers).

The development of CAD follows two paths - evolutionary and revolutionary. At one time, the first CAD for PCs and mid-range systems made a revolutionary coup. Now the market is being developed in an evolutionary way: product functionality is expanding, productivity is increasing, and use is being

simplified. But perhaps another revolution awaits us soon. Analysts from Cambashi believe that this will happen when CAD providers start using standard Sql-Type databases instead of file structures to store engineering data (drawings, three-dimensional models, lists of materials, etc.). As a result, engineering information will become structured, and it will be much easier to manage it than now.

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