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# PROSPECTS FOR STUDYING 3D MODELLING PROGRAMS IN MECHANICAL ENGINEERING

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***Annotation:*** *This article describes the process of active implementation of 3D technologies, notes the importance of studying and mastering the latest technologies and programs, and lists the qualities required of workers in technical fields at the present time*

***Keywords:*** *latest technologies, 3D modelling, CAD, Cad systems, programming, design, design, drafting*

Living in an era of active integration of modern technologies and programming, each person is puzzled by the study of the latest technologies for growth in the workplace and their bright future. Of course, today this applies to all spheres of life.

The technical spheres, in particular, incorporate the latest technologies and more and more convenient working and living conditions are being created for representatives of the technical spheres of production.

Moreover, the latest technologies are aimed not only at creating conditions for workers but also at protecting nature and natural resources, because this cycle is closely connected and cannot be separated from man and nature.

Technologies have been created to reduce waste in the air and nature, which contribute to improving the quality of life we live.

Speaking about innovations in the field of technology, it should be noted the importance of introducing 3D modelling which, in addition to increasing the quality of products and reducing the time spent on production, also reduces human physical labour, while increasing the requirement for mental performance. If earlier, for hiring millers, turners, and others, the ability to work with the machine and experience was necessary, but at this time the requirement reaches mental performance in programming and logical thinking, physical qualities play a smaller role.



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Currently, there are many CAD systems on the international CAD market that are being successfully introduced into production in various countries of the world. In today's market, the following systems are better known:

· "KOMPAS-3D" - manufacturer "Ascon" (Russia);

· "AutoCAD" - manufacturer "Autodesk" (USA);

· "AutodeskInventor" - manufacturer "Autodesk" (USA);

· PTC Creo 2.0 – manufacturer PTC (USA);

· "T-FLEX CAD 3D" - manufacturer of "TopSystems" (Russia);

· "Solid Edge" - manufacturer "Siemens" (Germany);

· "NX" - manufacturer "Siemens" (Germany).

I would like to pay special attention to the T-FLEX CAD 3D system of the domestic manufacturer TopSystems. A few years ago, developers, led by the programmers department of this company, created their own processor core, on the basis of which the CAD system software environment works. Also, T-FLEX CAD 3D is the only parametric system on the Russian market and one of the strongest parametric systems not only in Europe but also in the international arena. "TopSystems" provided great functionality for 3D modelling of products, making their product convenient for designing. But despite these advantages, the 3D modelling process of any CAD system still has its own difficulties when doing work, for example, if a part (assembly) of a mechanical engineering product has a complex geometry, many structurally important elements or a large number of parts (if an assembly unit). In order to successfully create a 3D model of a mechanical engineering product, you must have:

- knowledge in the field of engineering;

- Skill in using CAD systems;

- knowledge in the field of engineering graphics and descriptive geometry for drawing in a CAD system;

- knowledge of design documentation for reading and analyzing drawings;

- programming experience for parameterization of model variables;

- access to the content of state standards (GOST).

But for maximum success and effective results, the above abilities are not enough; for this, it is necessary to draw up an algorithm of actions before starting the task. A rational plan will allow you to use the minimum funds and reduce the time of work, and therefore the algorithm should be divided into stages:


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Technical task;

Design and technological documentation;

Modelling details:

- simple and small parts;

- technologically complex (middle level) parts;

- complex body and large-sized parts;

Standard products and factory fittings;

Assembly Modeling:

- connection of parts into units (subassemblies);

- complete assembly of all components of the product;

Animation of movement by variables and optimization of the model.

Each item must be described in detail. In the first stage, it is necessary to set a task or draw up a technical task. In the task, you need to determine what is the end result, if this is a 3D model of the product, then you need to collect all the information on this project, it includes the name, service purpose, principle of operation, drawings, specifications, assembly diagram and technical requirements of the product. A theoretical analysis of the object should be carried out for a complete representation of the final form of the product. After completing this task and collecting all the information, you can proceed to the next step.

The second stage implies a comprehensive study of the entire design and technological documentation of the project, which includes assembly drawings of the product, its components, individual drawings of all parts, specifications for each assembly unit, assembly diagrams and additional technological documents. In the process of studying, the details should be divided into categories according to the principles of design content and geometry complexity, for example 1 - simple in terms of design and geometry with small dimensions; 2 - average in terms of design and geometry, containing technological elements that are important in the principle of operation of the product, of various overall dimensions; 3 - complex in terms of design and geometry, containing many technological elements and high-level contour geometry, with large overall dimensions. The first category of parts includes flanges, stops, fittings, rings, shafts, bushings and other simple parts. The second category includes gear shafts, gears, axles, pistons, housing covers and other parts. And the third category includes complex body overall parts, mainly castings, as well as parts with a complex spherical geometry of a higher order profile.

About thirty years have passed since the appearance of the first commercial machines for the industrial application of additive technologies. Today, the possibilities of these technologies are so


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revolutionary that it is even difficult to assess the scale of the prospects that open up for developers and manufacturers. Certainly, advances in this area are already changing, and in the coming decades will significantly change part of our ideas about how to design and manufacture products.

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