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Possibilities of the AutoCAD Program in Creating Electronic Textbooks for the Course "Engineering and Computer Graphics"

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Annotation. This article provides examples to show that AutoCAD (Computer Aided Design (CAD)) has been and remains a powerful tool for technical graphics. Since Autodesk is a pioneer in the commercially available CAD market, Autodesk has developed CAD principles (which can be used by relatively untrained users), the nature and scope of commands, the sequence and specifics of their implementation. In terms of technical characteristics, AutoCAD is a complete tool that covers the entire range of functions in the area of the course "Engineering and Computer Graphics".

Keywords: CAD, education, engineering and computer graphics.

CAD, design and development of technical documentation using a personal computer are the most important modern means of informatization of design and technological activities, as well as an important part of the information environment in modern production, science and education, especially in higher technical educational institutions. Among these tools related to science and technology, AutoCAD and its modifications occupy an important place (Grechka, 2008; Finkelstein, 2009). AutoCAD is a powerful tool for automating graphic work based on personal computers. This provides the user with capabilities that previously could only be implemented on large and expensive computing systems: any hand-drawn drawing can now be built using AutoCAD.

AutoCAD is able to perform almost any graphic work (Nikulin, 2005). Thus, high speed and ease of creating a drawing and updating it is ensured, which, in turn, can significantly reduce the need to perform these processes compared to manual drawing.

In this regard, the system is widely used, in particular, for such purposes as:

- execution of architectural and engineering drawings;
- interior design and layout of premises;
- production of technological maps and organizational charts;
- production of drawings for the chemical, construction, engineering and aerospace industries;
- production of topographic and nautical charts;
- ceiling design;
- graphics and other images
- mathematical functions;
- stage design;
- note recording;
- production of technical illustrations and diagrams, trademarks and logos, greeting cards, etc. for other artistic and graphic works.

However, the capabilities of AutoCAD are not limited to the creation of static drawings.

If there are packages such as AutoDesc Renderman, 3DStudio, Autodesk Animator, AnimatorPro, etc. designed for coloring and “animating” a drawing, it becomes an effective tool for creating a cinematic effect and demonstrating the interaction of objects (Umarova, 2022).

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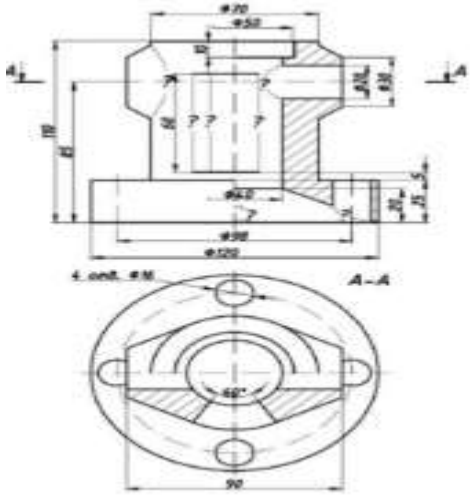

Figure (1): Task example.

Choice of structure model and boundary conditions. AutoCAD allows you to create not only ordinary drawings. Logically related fragments can be placed on separate layers or grouped into composite objects. And we consider them as a whole. AutoCAD "remembers" the position, size, color of constructed objects and writes this data to an internal database for their subsequent search, analysis and processing. AutoCAD can work with a wide range of personal computers and graphics workstations running various operating systems. When used with AutoCAD Civil 3D, AutoCAD Map 3D, and Autodesk Topobase, AutoCAD Raster Design provides tools for displaying and analyzing georeferenced imagery. The ability to receive and use geographic data from various sources allows us to easily and efficiently edit raster images, visually analyze and process spatial images. The program allows you to use images provided by central and local government agencies via the Internet or on CDs in popular Lizard Tech ECW and MrSID formats.

Quick Bird satellite imagery, Landsat FAST multispectral imagery and National Image Transfer Format (NITF) images to projects.

- holding the projection axes, dividing the drawing field into four equal parts;
- drawing a bisector by the polar method assignment in relative coordinates;
- drawing an axis of symmetry for three views, dividing in half a quarter of the drawing field;
- using the Endpoint, Midpoint, Center, and Intersect snap-ins by constructing a circle from the bases of the cylinders in the top view, and then other projections from the front and left using the Offset tool;
- drawing the center line of a truncated cone in the upper part of the array and building its projections in three views using the "Offset" tool and fixing it tangentially (for a top view);
- building a circle on the vertex, on which the centers of cylindrical holes are located based on the template, and creating holes using the Array tool in polar mode (Fig. 1).

Construction of lines of intersection of surfaces:

- determination of points of intersection of a truncated cone with a cylinder using the method of auxiliary section planes (frontal projection), the construction of these points on the left side of the front view and on the left side of the view;
- after drawing the required number of points, we connect them with a smooth curve using the Spline tool, and then delete the auxiliary lines.

Building a section in front and top view:

- we build a slot in the right side of the front view;
- determining the starting point of intersection of a cylindrical hole inside a truncated cone in the front form with a through cylindrical hole inside the part;
- determining the starting point for the intersection of a cylindrical hole in the base of the part with an internal hole in the form of a truncated cone in the front view;
- determination of the boundary points of the protrusion of the cylindrical hole (along the center line) in the inner part of the base;

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- connection relative to the points of intersection of a smooth curve (in three places where there were question marks) using the Spline tool, make auxiliary lines (Fig. 2).

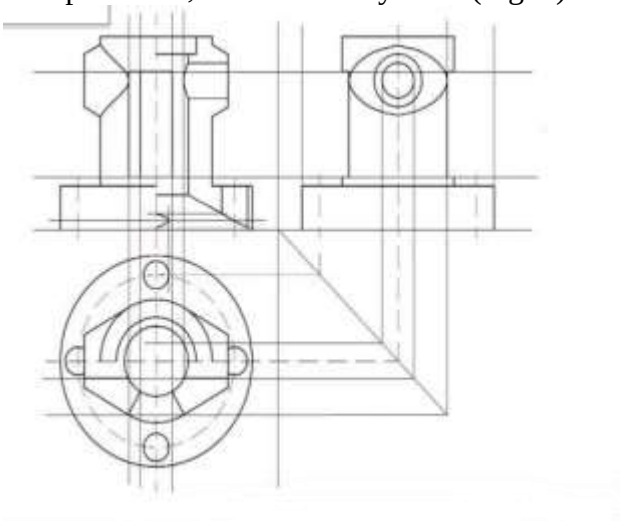

Figure (2): ***Construction of lines of intersection.***

Construction of a given horizontal section in the top view and a through prismatic hole in all images:

- construction of a horizontal section from above on the section plane A-A;
- construction of protrusions according to the given dimensions through a prismatic aperture in the front and left views;
- dismantling of auxiliary structures;
- using the hatching tool, hatch the cross-sectional shapes on the images, making sure they are closed;
- indicating the position of the section plane A-A and the mark of the section (text layer).
- using the Dimension Style tool to set options;
- size with the "Size" tool;
- saving the drawing and printing it (Fig. 3).

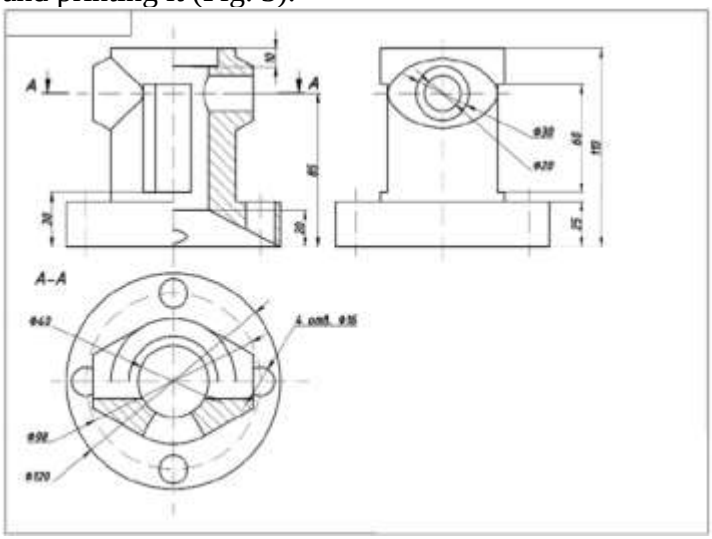

Figure (3): Ready-made drawing of a part of the "Body" type.

Conclusions

These examples show that AutoCAD has been and remains a powerful tool for technical drawing. In this regard, the system has the widest application and is used for the following purposes:

- execution of architectural and engineering drawings;
- interior design and layout of premises;
- production of technological maps and organizational charts;

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- production of drawings for the electronic, chemical, construction, engineering and aerospace industries;
- production of topographic and nautical charts;
- ship design;
- graphical and other representation of mathematical functions;
- stage setting.

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