

ENGINEERING GEOMETRY AND COMPUTER GRAPHICS

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USING THE GRAPHICAL EDITOR "КОМПАС 3D"
IN TEACHING COMPUTER ENGINEERING GRAPHICS*Tokhirov Azamjon Ibrokhim ugli**trainee teacher, Andijan Machine building institute,
Department automation of machine-building production,
Uzbekistan, Andijan**E-mail: azamjonmagistr1991@gmail.com*ИСПОЛЬЗОВАНИЕ ГРАФИЧЕСКОГО РЕДАКТОРА «КОМПАС 3D» В ОБУЧЕНИИ
КОМПЬЮТЕРНОЙ ИНЖЕНЕРНОЙ ГРАФИКЕ*Тохиров Азамжон Иброхим угли**учитель-стажер, Кафедра автоматизации машиностроительного производства,
Андижанский машиностроительный институт,
Узбекистан, г. Андижан**E-mail: azamjonmagistr1991@gmail.com*

ABSTRACT

This paper discusses ways construction of drawings using the capabilities of the graphic editor "Compass 3D" when teaching students computer engineering graphics.

АННОТАЦИЯ

В данной работе рассматриваются способы построения чертежей с использованием возможностей графического редактора «Компас 3D» при обучении студентов компьютерной инженерной графике.

Keywords: engineering and technical literacy, computer engineering graphics, three-dimensional modeling, drawing, graphic editor "Compass 3D".

Ключевые слова: инженерно-техническая грамотность, компьютерная инженерная графика, трехмерное моделирование, чертеж, графический редактор «Компас 3D».

Introduction

The success of a specialist in the future is not determined only knowledge and skills, but also the degree of its formation professional qualities. For an engineer, this is usually engineering and technical literacy, a creative approach to the performed work, developed spatial thinking, ability to navigate in design and technological documentation, use capabilities of computer technology, readiness for constant selfeducation.

For the specialty "Software of information technologies" the curriculum provides for the discipline "Computer Engineering Graphics". This is one of the disciplines constituting the basis of engineering and technical education. Knowledge, skills and abilities acquired during the study of the discipline necessary both in the study of general engineering and special disciplines and in the subsequent engineering and innovation activities. As a result of studying the course of computer engineering graphics, the future engineer gains knowledge of building a drawing, the ability to read and compose graphic

and text design documentation in accordance with the requirements of standards, skills to apply the acquired knowledge and skills in practice.

The principle of visibility

Three-dimensional modeling began to actively develop from the beginning 1990s. Despite this, many more designers, engineers and teachers underestimate the capabilities of the virtual model in development of a new product and perceive this process as some entertainment. However, flat design is unnatural for person and requires complex preparation. The person lives surrounded three-dimensional objects and thinks in three-dimensional space, it is easier for him perceive a virtual volumetric model than reading flat drawing to imagine a three-dimensional body.

A new direction of computer graphics - 3D modeling, which is based not on a drawing, but on a three-dimensional geometric model, has become widespread in various fields human activity.

Computer graphics enable design development in two directions.

The first direction is based on a two-dimensional geometric model and use of the computer as a special tool, allowing to significantly speed up the design process and improve the quality of design documents. Central to this design approach is the drawing, which contains all the necessary graphic information for manufacture of any product.

The second direction is based on spatial geometric model of the product, which is more visual way of presenting the original and more powerful and convenient a tool for solving geometric problems. Drawing under these conditions plays an auxiliary role, and the methods of its creation are based on methods of computer graphics.

When using the first direction, the exchange of information carried out on the basis of design, regulatory and reference and technical documentation. When using the second direction information exchange is carried out on the basis of a computer representations of a geometric object, which contributes to effective functioning of software systems computer-aided design.

When introducing technical means into the learning process geometric and graphic disciplines, above all, the principle of visualization of teaching is implemented, which ensures mastering knowledge of students. In teaching such disciplines, the principle clarity is of paramount importance. This is explained the fact that both graphics and geometry study shape, size and mutual the location of various objects in space.

Drawing and graphic editor "Компас 3D"

For teaching the discipline "Computer Engineering graphics "for students of the specialty" Software information technology "used drawing and graphic editor "Компас 3D".

"Компас 3D" is a product of the Russian company Ascon, which has become the standard for thousands of enterprises and tens of thousands of professional users.

It is a computer-aided design system that used for the development of design and engineering documentation, allows you to model individual parts and prefabricated objects containing standard and original in the design elements.

A program of this kind is designed to educate students techniques of three-dimensional design and plane drawing and received widespread use in training sessions. System computer-aided design is also used for product design in industries such as mechanical engineering (transport, agricultural, energy, oil and gas, chemical, etc.), instrumentation, aircraft construction, shipbuilding, machine tool building, car building, metallurgy, industrial and civil construction, consumer goods consumption, etc. Its popularity is due to the fact that the rules working with it is easy to learn, and a rich collection of templates is able to ensure the acquisition of professional competencies in technical specialties at the proper level. An important factor is the fact that that this program is free and available to any student, that allows you to enter hours of independent extracurricular work. If a the student does not have time to master the material in the lesson or wants it fix, he can always do it on his own at home conditions.

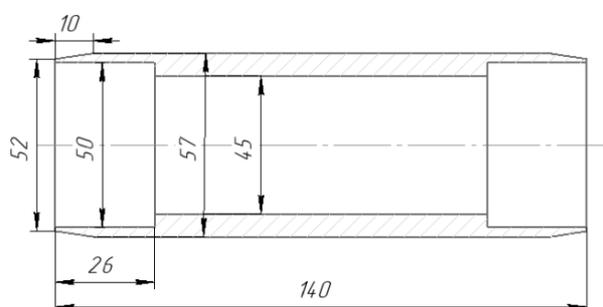


Figure 1. Drawing of the "Roller"

The "Компас 3D" system has very wide the ability to create models of the most complex structures, such as individual parts (Fig. 1) and assembly drawings (Fig. 2, Fig. 3). Moreover, the modeling process is similar to the technological process manufacture of the product. By virtual assembly of several parts in an assembly unit, the user can temporarily disable an image of any detail or perform any complex cut. In "Компас 3D" volumetric models and planar drawings are associated among themselves, any editing of the model will entail a change in a drawing generated from a given model.

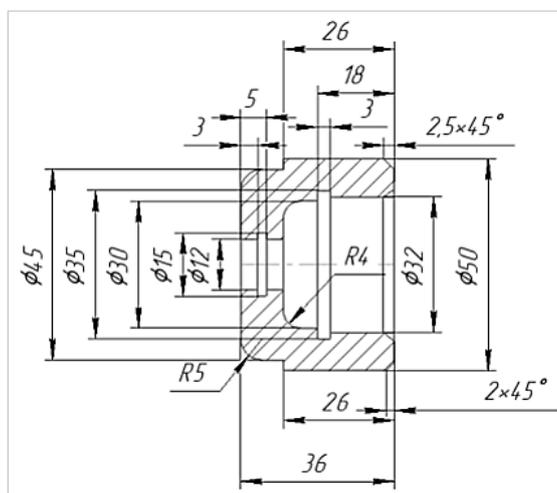


Figure 2. Drawing of details "Body"

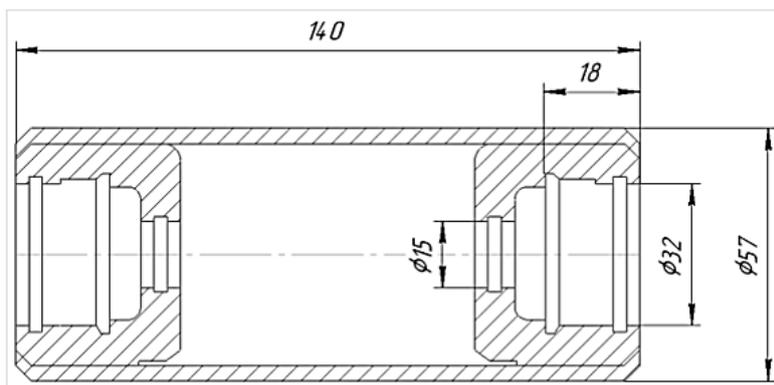


Figure 3. Assembly drawing "Roller"

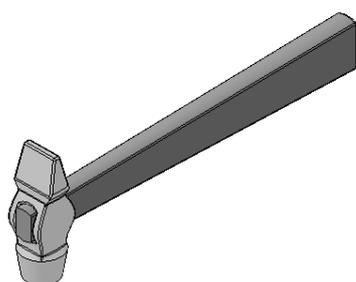


Figure 4. Assembly unit "Hammer"

- The "Компас 3D" system allows you to:
- perform boolean operations on typical formative elements,
 - create surfaces,
 - set associative parameters of elements,
 - build auxiliary lines and planes, sketches, spatial curves (broken lines, splines, various spirals),
 - create structural elements - chamfers, fillets, holes, stiffeners, thin-walled shells,
 - create any arrays of shaping elements and assembly components

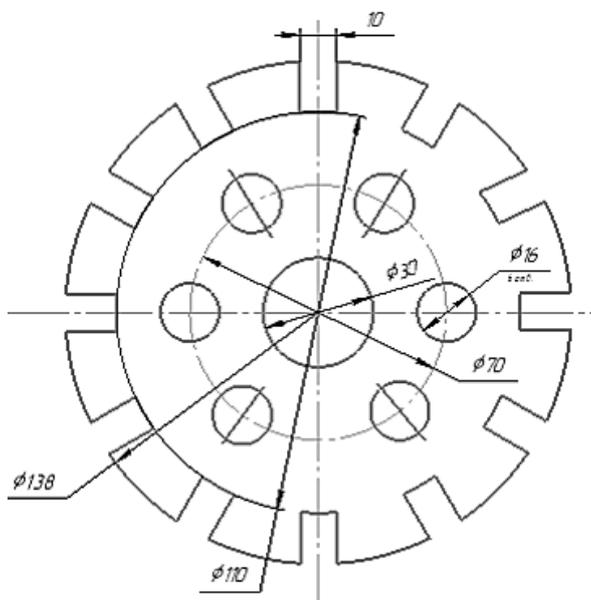


Figure 5. An example of creating an array of elements on a plane

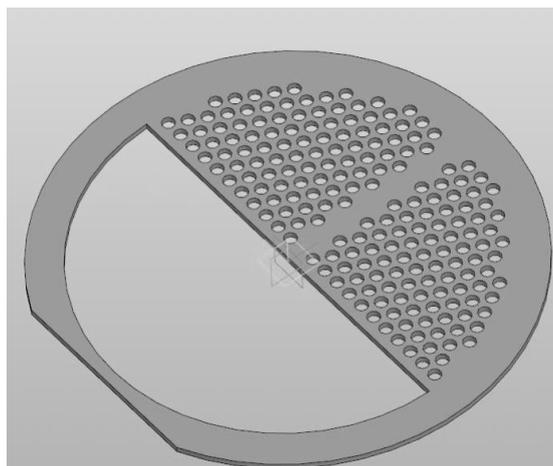


Figure 6. An example of creating an array of elements in 3D space

- insert standard products from the library into the model, generate custom libraries of models,

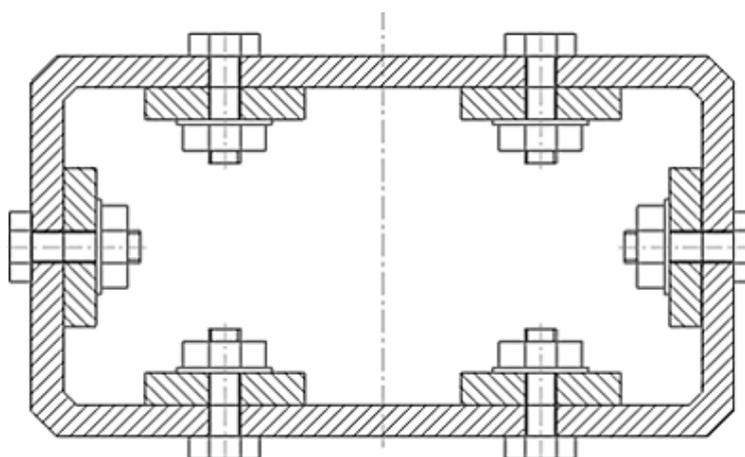


Figure 7. An example of creating a detachable connection using library models

- model components in the context of an assembly, mutually define parts as part of an assembly,
- overlay mates on assembly components,
- edit parts and assemblies,
- override the parameters of any element at any stage a design that rebuilds the entire model.

Using this program allows you to teach students on higher level - the level of designing three-dimensional models. But also practice has shown that the majority of students show interest in working in this system, some are studying it in depth and yourself. Students note that while working in this program, the drawing is neat, clear, easy to carry out corrections, while the result of the correction is invisible. As well as the program saves time because repetitive operations can be performed with one command, symmetrical parts can be drawn in a specific area of the drawing, and then for copy use symmetry operations, most geometric constructions are made automatically.

Teaching students to work in this program begins with acquaintance with the interface, basic techniques of working with virtual instruments and commands. In the methodological recommendations for laboratory work each step is

provided with detailed instructions and screenshots, making it easier for them navigate the program at the initial stage. With every assignment the complexity of the work increases, the description of the execution process simplifies, opens up opportunities for manifestation independence.

First, it is the creation of drawings in the creation space 2D image "Drawing" or "Fragment". In this case the drawing is built using the "Geometry" toolbar using lines, segments, circles and other geometric figures. This method differs from the traditional one only in that instead of pencil and other tools student works with computer mouse and keyboard. But even so, the quality of the drawing is significant improves, increases the accuracy of construction. Standardized line types and fonts are embedded in the system, which frees the student from responsibility of graphic design, its main task.

Next, students learn to create three-dimensional models of the depicted objects in the "Detail" construction mode, and then create an associative drawing based on this model in automatic mode. Three-dimensional modeling and automated construction of a drawing based on the solid model created at the beginning is a discovery for students.

This is due to the fact that students who have mastered 2D drawing often find that 3D modeling is difficult, requiring a lot of time and effort to learn. In fact, everything turns out to be quite the opposite, in which students personally are convinced when they master spatial drawing.

On the other hand, 3D modeling contributes to development of spatial thinking and analytical skills student, since in the process of working on creating a model it is necessary analyze its shape, highlighting the main components, plan the order of work on sketches and their content.

When to create an associative drawing, you need to select the correct plane for the first sketch and here it is necessary to draw the attention of students to differences between the coordinate system set by the developers in graphics editor "Compass 3D", and the standard system coordinates adopted in engineering graphics and descriptive geometry. The frontal plane in the graphical editor "Компас 3D" is the XY plane, it corresponds to the main view on associative drawing. The top view, respectively, will be projected onto the XZ plane, and the left view onto the YZ plane.

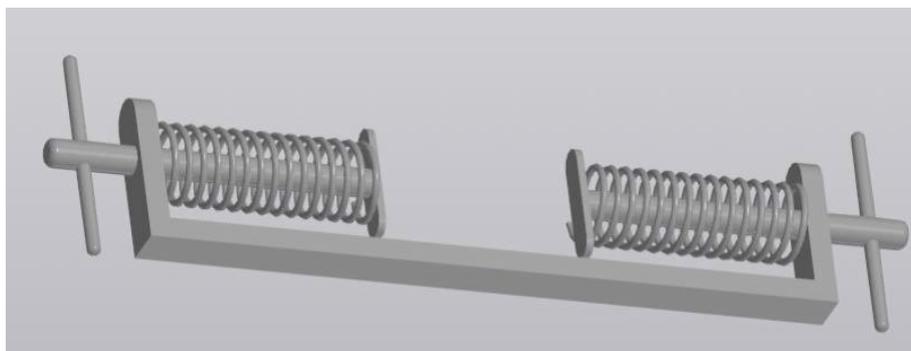


Figure 8. Three-dimensional model of the "Hand press" part

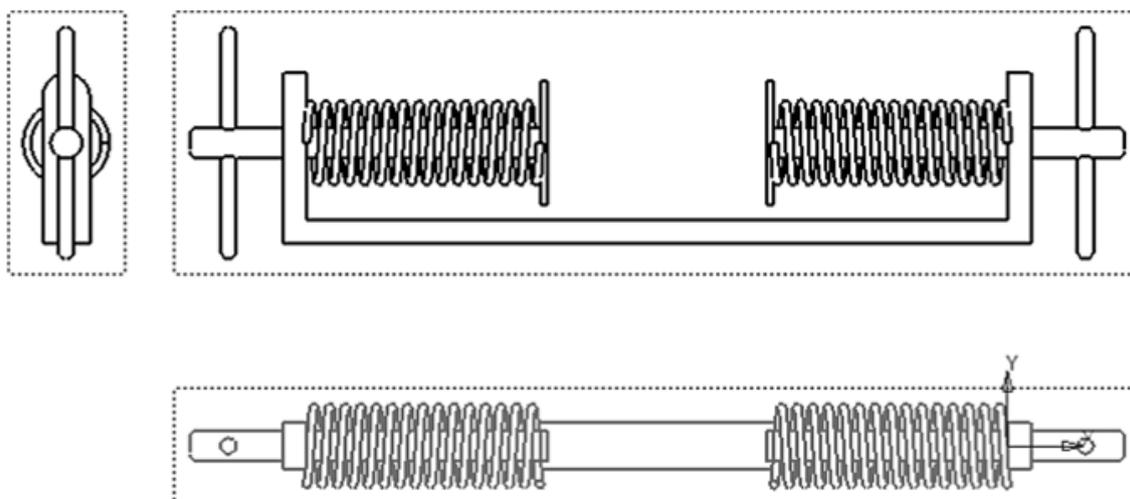


Figure 9. Associative drawing made for 3D Models of the "Hand Press" part

Conclusion

In conclusion, we can conclude that, despite the fact that in the future, the traditional method of building drawings pencil will remain unchanged, the education of an engineer, implemented without the use of information technology, cannot be considered modern.

Design systems, in particular Compass-3D, increase the capabilities of a specialist and facilitate his work, allow you to eliminate routine and repetitive tasks, while the author is not without independence in making this or that decision and the possibility realization of their creative potential. Working in programs computer design, a student or a ready-made specialist can consider alternatives to constructions, explore them without significant losses in case of the wrong choice.

Working in the Compass 3D system increases cognitive interest students to the educational material, makes the

educational process more effective, thereby allowing the teacher to fully implement such general didactic principles as:

- consciousness and activity, since students consciously and independently master this software product;
- visibility, which is achieved by creating volumetric models;
- availability, which is due to the fact that the program is free, it includes an interactive tutorial, which allows you to master the work with the system;
- strength, which is explained by the fact that in the learning process there is a systematic repetition of operations, skills are formed sequentially, which contributes to their transition to strong skills.

Thus, these principles are fully implemented and qualitatively, thereby ensuring the high efficiency of educational activities.

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