Study of possibilities of editor NanoCAD for design of building elements

N S Kuvshinov

Department of Engineering and Computer Graphics, South Ural State University, 76, Lenin Avenue, Chelyabinsk 454080, Russia

E-mail: kuvshinovns@susu.ru

Abstract. The paper studies the possibilities of using a new home-produced nanoCAD editor for the design of building elements. Any product design nowadays is based on the 3D-model – 2D-model – 2D-drawing advanced technology. The focus is on 3D modeling. It is shown that for 3D modeling in the nanoCAD editor, which replaces the well-known AutoCAD, there are various tools. These include numerous 3D commands and the corresponding dialog boxes. As an illustration, the procedure and step-by-step examples of building up the intersection lines for composite surfaces, views and axonometric projections are given. The transition to the nanoCAD editor is proved to be appropriate and relevant.

1. Introduction

There are studies related to the design of elements of building products, for example, [1,2], and theoretical studies in the field of descriptive geometry aimed at creating promising geometric shapes for future building structures and structures [3-10]. Most of the works are based on the use of the AutoCAD editor [11-15].

AutoCAD is a graphic editor of the American company Autodesk (www.autodesk.com).

The design of building elements based on the use of foreign graphic editors becomes today a thing of the past. There is an active process and the search for new, competitive domestic products, including, in particular, graphic editors. A direct competitor to the AutoCAD editor is currently the nanoCAD editor [16] with its direct support for standards of the Unified system for design documentation and direct exchange of the drawing files with the AutoCAD editor.

NanoCAD is a graphic editor of the Russian company Nanosoft (www.nanocad.ru).

In view of the foregoing, it became necessary to make a study-based preliminary assessment of the possibilities of using the domestic nanoCAD editor [16] to design building elements.

2. Research methods

To perform the study, the building elements were drawn in nanoCAD and then compared with the results of building them up in AutoCAD.

Two points were taken into account during the research.

1) Any complex product consists of a set of the simple geometric shapes and their combinations. The simplest and most commonly used in practice geometric shapes of building products (in addition to, for example, farms and beams), are prisms, pyramids, and cylinders [10,17].
2) Currently, almost any product is designed using 3D-model – 2D-model – 2D-drawing technology [1,10].

As a tool for research, the nanoCAD version 8 editor, the 2017 release, was selected with an additional licensed 3D module and components for 2D modeling.

The study was performed as follows. Initially, sketches based on the construction of flat contours and components of the submenu "2D Sketch" were built [16]. Later, solid bodies were built on the basis of 2D sketches using the 3D modeling components. The choice of 3D modeling tools is directly related to the sequence of building and using the 3D Extrude and 3D Rotation dialog boxes with the Union, Subtract, and Intersect control buttons [16].

The intersection line projection visibility and the visibility of surface sketch projections were determined by changing the settings in the “Setting nanoCAD Mechanics” dialog [16], which was accessed as follows: left-click on the drop-down menu “3D” – left click on the submenu “Settings” – left click on the “3D” tab – then select the “Yes” checkbox in the “Show in Views” line of the “Invisible Lines” folder [16].

3. Results of study

We consider the study of the nanoCAD editor capabilities through the examples of constructing a line of intersection of building elements and a specific building product.

Example 1. The construction of the intersection line of parts of conical and prismatic surfaces.

The construction was carried out according to the diagram shown in Figure 1.

1) The Polyline, Polygon, and Contour commands were used to build 2D sketches of a triangle and a polygon. Later, 3D rotation of the 2D sketch of the triangle and 3D extrude of the 2D sketch of the polygon were executed with the use of the “Union” operation. This was the first stage.

2) In the second stage, the transition from the image of the 3D model in the South-West isometry to its top view image was carried out.

3) In the third stage, three principle 2D-views and a view in the South-West isometry were built with the use of the 2D View and 2D Projection View commands.

Example 2. The construction of the intersection line of parts of a conical surface and a sphere.

The construction was carried out according to the diagram shown in Figure 2.

Figure 1. The stages of constructing the intersection line of parts of conical and prismatic surfaces.
1) The Polyline, Circle, Crop, and Contour commands were used to build 2D sketches of a triangle and a half-circle. Later, 3D rotation of the 2D sketch of the triangle and 3D extrude of the 2D sketch of the half-circle were executed with the use of the “Union” operation. This was the first stage.

2) In the second stage, the transition from the image of the 3D model in the South-West isometry to its top view image was carried out.

3) In the third stage, three principle 2D-views and a view in the South-West isometry were built with the use of the 2D View and 2D Projection View commands.

**Example 3.** The construction of the intersection line of parts of conical and cylindrical surfaces. The construction was carried out according to the diagram shown in Figure 3.
Example 4. The construction of a building product.

The construction (Figure 4) was carried out according to the general procedure given in Examples 1, 2 and 3.

![Figure 4](image.png)

Figure 4. The example of the building product: a – three principle views; b – a view in the South-West isometry; c – the view in the South-West isometry in 3D visual style, hidden.

A similar product had been built earlier in the AutoCAD editor [10]. The results of these constructions were identical.

4. Conclusion

It is possible to design similarly a 3D-model of any building elements, with the insertion parameters in the dialog boxes of the nanoCAD editor immediately visible in the drawing field by pressing the OK button before the operations are completed. This increases the visibility of 3D modeling, which is especially important in the design and is fundamentally different from the AutoCAD editor, for example, [1,2,9,10], in which changes are entered by options on the command line, and the results are visible only after confirmation by pressing Enter.

For the new training course “Computer graphics” planned in the future, the author has prepared a manuscript of the book “NanoCAD Editor. Adaptation to the Educational Process”, 437 pages in A4 format, including sections on 2D- and 3D-modeling.

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