Factors Providing Independent Cognitive Activity in Teaching Engineering Computer Graphics

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ABSTRACT

The article proposes to consider the construction of second-order curves as a cross-section of a circular cone with planes of different positions and the origin of foci as a result of the point of contact of a sphere inscribed inside a triangle composed of extreme generators and a secant plane. This approach of presenting the material, which is absent in textbooks, according to the opinion and experience of the authors, contributes to the activation of cognitive activity of students.

Keywords: Engineering computer graphics, independent cognition, second-order curves, quality of education, graphic education, cognitive activity, ellipse, spatial imagination

Modern information technologies implemented through computers become such means in human activity, with the help of which he gets the opportunity to create, store and transmit new information over an unlimited distance, and, if necessary, to call and use it. But his penetration into the learning process generates a number of problems related to didactics, with the theory and practice of learning, with the purpose, content, laws and principles of learning.

When teaching engineering computer graphics, the most important of them is the formal assimilation of educational material by students and the need for its dry memorization, non-fulfillment of the principle of awareness. The main reason for this is that most of the drawing execution processes are programmed, and now you just need to know with which tools on the monitor you can make the necessary geometric constructions and how to use them.

This circumstance remains a big problem when teaching engineering computer graphics, that is, all sections of descriptive geometry and drawing, and their conscious perception by the student, since now the student should know enough techniques for using the dashboard on the monitor for geometric, projection, engineering, construction and other areas where there are sections of drawing.

As a result, during the learning process, the subconscious mind is forced to bypass the principle of awareness. But it's also worth saying that not the whole process is fully programmed. Didactic principles are interconnected by such a system that making changes to any of them leads to a change in all other principles.

The possibilities of eliminating the above shortcomings with the help of himself are not only there, but also limitless. Consider, for example, the execution of second-order curves in drawing. How the teaching and execution of second-order curves in drawing began in the history of teaching this discipline, that is, in what content and scope it was taught, remains to this day.

Some of the features necessary to perform second-order curves are taught only in drawing. All other properties related to them are considered in analytical geometry. In addition, analytical geometry is not currently taught in all

universities. Of course, with the effective use of these opportunities, the effectiveness of training will increase several times.

Consider, for example, the topic of second-order curves. It is known from analytical geometry that they are represented by second-order equations. At the same time, they are also conic sections. Since the nature of these lines is historically well studied compared to other higher-order curves, they are widely used in engineering and in life. One of the main features of second-order curves is the presence of focal points and associated series of symmetries in them. But how these dots appeared is not mentioned in the literature. As a result, the student will be limited to this information only.

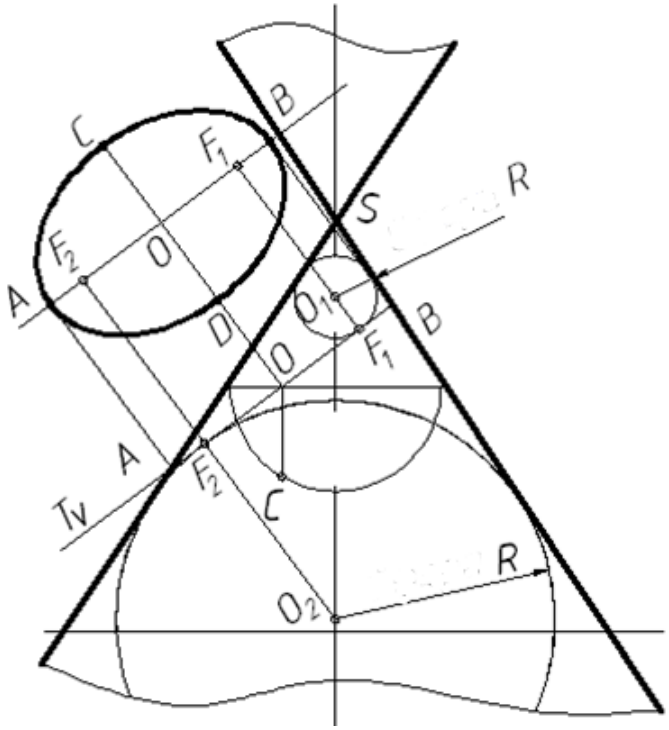

Figure 1

Second-order curves are also called conic sections, because a circular cone is such a wonderful surface, which is the only surface that unites all second-order curves and their special cases. In addition, through this surface, you can check all the geometric properties of curves formed naturally. Therefore, in the process of learning conic sections, limitless opportunities open up for activating the cognitive activity of students and directing them into a creative path.

Consider, for example, the formation of an ellipse line. We cut off this circular cone relative to its axis with an oblique frontal Tv, projecting the plane To. This plane intersects the surface of the cone along the curve of the ellipse. The major axis of the ellipse, i.e. AB, will be equal to the distance between the points of intersection of the plane with diametrically opposite axes of the cone. To make a small axis of the ellipse, a parallel, the center of which passes through the point O, we will draw it to the frontal position, turning it 90 degrees, and draw a vertical straight line through O. The OS will be equal to half of the minor axis of the ellipse.

Now we will draw a sphere through the center O1, attaching the edges of the conical surface S passing through the vertex and intersecting it to the plane (trace) (of course, this center will first have to be found by geometric methods). Then, from the center of the drawn sphere, we lower the perpendicular to AB. Its intersection point with AB determines the position F1 of one of the foci located on the major axis. Now, on the underside of the cutting plane T, we will draw a sphere with the center O2, applying forces to the inner surface of the cone. This determines the position of the second Focus F2 of the sphere, where the point of attempt AB is on the major axis of the ellipse. This case, of course, was given for completeness:

F1, located on the major axis, will be moved symmetrically relative to O1.

After this method of constructing an ellipse is mastered, it is recommended that students themselves draw and check the curves of parabolas and hyperbolas in this way. The study of second-order curves in such a way as to get to the bottom of it provides students' research ability and a scientific approach to the problem.

It is worth noting that all drawing is done on a computer through one of the drawing programs. For some reason, there are no programs for drawing second-order curves, except ellipses, in computer drawing programs on it.

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