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IMPROVING VISUALIZATION SKILLS OF STUDENTS IN PROJECTION WITH ELEVATIONS

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Abstract. Engineering graphics is one of the cornerstones of an engineering education. The future engineer must know the main principles of projections to draw or "read" different drawings. For Water and Land Management specialists it is very important to know fundamentals of projection with elevations (coted projection with applications). The major problem for the students when using the described method is to visualize a spatial situation from its planar representation. For solving problems by the method of projection with elevations, different transformations of these projections are used. In this work it is offered to use the method of auxiliary projection as the method of transformation projection with elevations. Such method improves visualization skills of students.

Key words: descriptive geometry, projection with elevations (coted projection), auxiliary projection.

1. Introduction

In all branches of engineering geometrical problems in three dimensions may be solved in the plane by methods of Descriptive Geometry [1]. At Lithuanian University of Agriculture for students of the Faculty of Engineering it is offered course of orthogonal projection (method G. Monge) and most part of 2 credits Descriptive Geometry course in the program of study for students of Water and Land Management faculty takes up projection with elevations.

This method is not used often, but it is important for Water and Land Management specialists. At the World Wide Web I find this course is used only at Slovak University of Technology [2], Technical University of Cluj Napoca (Romania) [3] and Agricultural University of Cracow [4], but I think that information is not full.

2. Solving geometrical problems in projection with elevations

In projecting geometrical elements we have only one projection onto horizontal (x, y) plane and third coordinate z (elevation) is indicated as numerical mark. The main difficulty for students is to visualize what is presented at a drawing. For example, the projection of the cone they saw as circle, the horizontal cylinder – as rectangle, etc.

For resolving such problem as finding intersection of cutting plane DEF with the pyramid ABCS (Figure 1), the method of contour lines is usually used. To draw contour lines of the plane it is interpolated between points E and D, and for contour lines of pyramid – edge CS. Contour lines are drawn through the points as the same elevations. The line of intersection plane with the pyramid is drawn through the points of equal contours intersections. The pyramid edges visibility is defined by the differences of the plane and the pyramid elevations.

Such method is not visible, students have difficulty "to see" spatial form of the polyhedron. We offered for students to use the method of auxiliary projection as the method of transforming projection with elevations [5, 6]. A few years practice shows that this method is readily comprehensible for students and they often use it.

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An example of founding the line of intersection the plane DEF and pyramid ABCS is shown in Figure 2. The direction of parallel lines of sight s is chosen freely parallel to the straight line DE, because in this case the line DE in auxiliary projection appears as a point $\overline{D}' \equiv \overline{E}'$, and the plane DEF appears as a line.

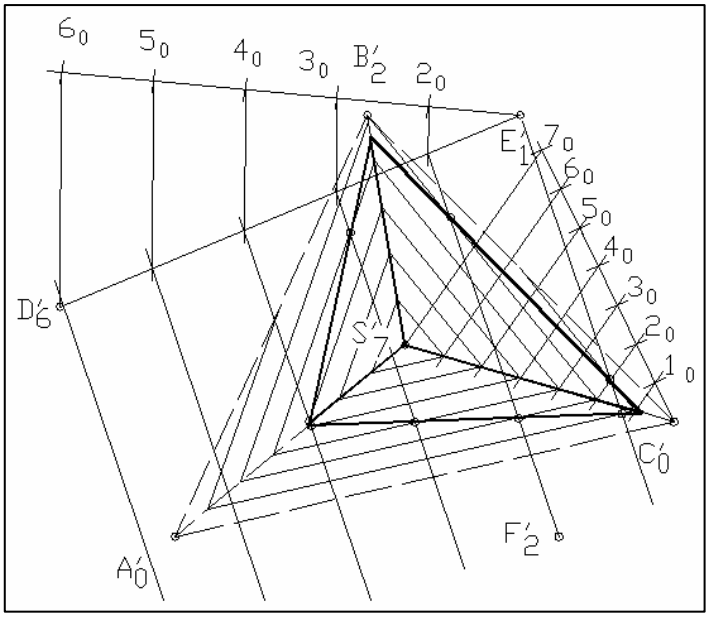

Fig.1 Finding intersection of cutting plane with pyramid using the method of contour lines

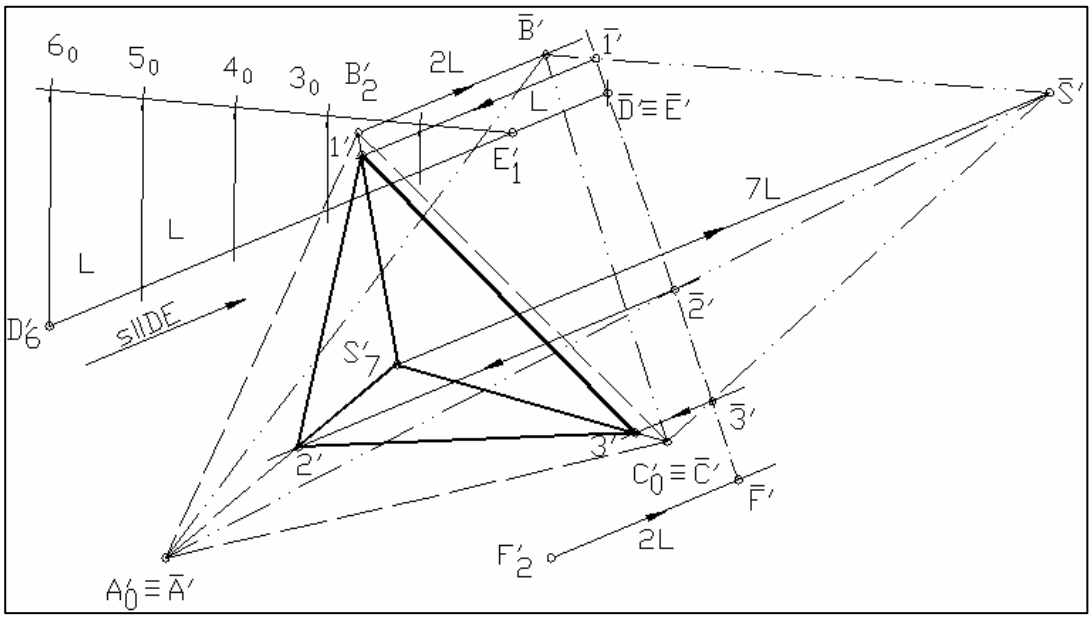

Fig. 2 Finding intersection of cutting plane with pyramid using the method of auxiliary projection

Where this line intersects with auxiliary projection of the pyramid $\overline{A}'\overline{B}'\overline{C}'\overline{S}'$, we find auxiliary projections of points $\bar{1}'$, $\bar{2}'$ and $\bar{3}'$, in which edges of the pyramid B, A and C

pierces the plane DEF. Projections of points 1', 2' and 3' in primary projection of the pyramid are found by projection in the opposite s direction. Auxiliary projections of the plane and the pyramid are helpful to define visibility. The part of the pyramid on the right to the plane line is visible and the part to the left is not visible.

Auxiliary projection, as the method of transforming projection with elevations, helps students to understand drawings better and improves their visualization skills.

3. Conclusions

Specialists of Water and Land management according to their working specific must know fundamental principles of the projection with elevations. The main difficulty in the teaching of this method of representation is in doing students to "see" the objects spatial form. The method of auxiliary projection as the method of transformation of projection with elevations is readily comprehensible for students, it helps them to understand drawings better and improves their visualization skills.

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