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Activation of Students in Homothetic Transformation

Nurlan Tashimov[1], Dildora Alimardanova[2], Sevinch Abdumutalibova[3]

[1]Associate Professor, Tashkent State Pedagogical University
Tashkent, Uzbekistan

[2]Student Tashkent State Pedagogical University
Tashkent, Uzbekistan

[3]Student Tashkent State Pedagogical University
Tashkent, Uzbekistan

Abstract – This article discusses ways to activate the cognitive activity of students in the study of the topic of transformation of orthogonal projections. Homothetic transformation is used as examples.

Keywords – Homotetics, Homology, Descriptive Geometry, Knowledge, Skills, Activation, Cognitive Activity, Transformations Of Orthogonal Projections.

Parallelism of lines is not known to be an invariant of homological transformations. In General, homologies that are straight and parallel before conversion do not preserve this property.

Graphically, the homology can be easily represented as the Central projection of a plane figure from one plane P to another Q. The corresponding lines intersect on the homology axis, which is the intersection line of the planes P and q.

If a shape located in the plane P is projected from the center of S to a plane q parallel to P, then the line of intersection of the planes (the homology axis) in this case is not a straight line. Therefore, the corresponding lines must be parallel, since they will intersect at the points of the wrong axis.

Before us is a special case of homology is called homotheties.

Homothety is nothing but a similarity transformation, where the center of similitude is the centre of homology. Otherwise, homothety-homology with non-native axis and a private centre.

The main property of homotopy is the constancy of the ratio of segments of the corresponding lines. This ratio is also called the coefficient of homothety.

Homothety transforms each figure into a similar and similarly situated, so the homothety coefficient is the coefficient of similarity.

The use of homotopy properties makes it possible to simplify the solution of some problems for determining the intersection line of surfaces.

In the homothetic method, which we will later call the similarity method for simplicity, the well-known Monge theorem on double touch is used.

As you know, this theorem States that "every two surfaces of the second order that have a double touch intersect with each other along two flat curves of the second order".

Before proceeding to the description of the similarity method, we note some consequences that follow from the Monge theorem.

1. If two second-order surfaces are inscribed or described near the third second-order surface, then they intersect along flat curves.
2. If the intersection curve of surfaces is an ellipse, then you can always find the projection direction in which the ellipse is projected onto a plane perpendicular to that direction, in a circle.
3. Second-order curves resulting from the cross-section of a second-order surface with parallel planes are similar.
4. Two similar and similarly located surfaces of the second order are dissected by parallel planes along similar and similarly located curves.

As an example of determining the direction of parallel projection, in which an ellipse is projected into a circle, consider the following problem.

Let a straight circular cone S be dissected by the front-projecting plane P (Fig. 1). The real value of the large axis of the ellipse is equal to the segment a1b1. The minor axis is equal to the cd segment. From the point o1, we describe a circle with a radius equal to half the value of the minor axis of the ellipse cd. The direction of the front projection of the projection direction coincides with the direction of tangents drawn from the ends of the large axis of the ellipse-points a1, b1 to this circle. The plane R on which the ellipse is projected in the circle a1b1c1d1 must be perpendicular to the resulting projection direction b1b1.

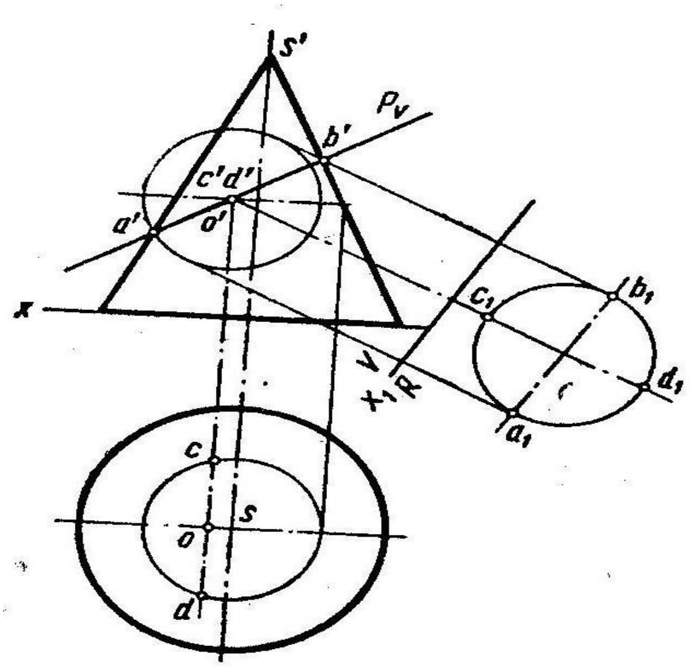

Fig. 1

Marked in PP. 1-4 properties make it possible to solve positional problems for determining the intersection line of two second-order surfaces.

The essence of solving problems using the similarity method is as follows.

If you specify two second-order surfaces Ψ and Ω, the intersection line of which you want to determine, then in the free space of the drawing, we build similar and similarly located surfaces Ψ1 and Ω1, described near the spherical surface. These surfaces will intersect along two flat curves I1 and II1.

By the similarity property, the figures Ψ and Ω will intersect along curves I and II, similar to I1 and II1. To determine the points that belong to these curves, you can (based on corollary 4) use auxiliary secant planes that are parallel to the planes where I1 and II1 are located.

If at least one of the curves that intersect the surfaces Ψ and Ω is an ellipse, then the auxiliary plane Q should be drawn parallel to the plane of this ellipse. In this case, the plane Q will also dissect the surfaces Ψ and Ω along ellipses similar to and similar to the ellipse whose plane is parallel to the auxiliary planes (based on corollary 3).

Now, having obtained an ellipse in the section, we can choose the projection direction and, accordingly, the auxiliary projection plane on which it is projected into the circle (see corollary 2).

Dissecting the surfaces Ψ and Ω with a number of planes Q1, Q2, Q3, etc., we get several pairs of ellipses of the section and, accordingly, several pairs of circles.

The points where the circles intersect are auxiliary projections of the points of the intersection curve.

Using reverse rays, we transfer these points to the main projections: connecting the projections of the same name in a certain sequence with smooth curves, we get the projections of the desired curves.

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