METHODICAL INSTRUCTIONS FOR TRIMETRIC PROJECTIONS

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Annotation. This article describes theoretical material the type of trimetric projection of axonometric projections for graphical construction.

Keywords. Clear image of axonometry, projection its direction, contraction of coefficient, axonometric plane, trimetry, trimetry axes.

It is known that in orthogonal projections it is more convenient to draw, and the metric characteristics of the object are preserved, because in orthogonal projection the object is placed more comfortably relative to the planes of projections. Orthogonal projection drawings can be used to determine the internal and external appearance of an object using cuts and sections.

However, it is difficult to imagine their spatial shape according to the drawings of the object in orthogonal projections. In this case, it is necessary to fill in the drawing of the product with a clear image. Such images can be axonometric projections. However, not all axonometric projections are clear. The sharpness of an object depends on the direction of projection and the position of the projection plane. Axonometric projection is abbreviated as axonometry (axonometry is a Greek word meaning axon, metrien, I measure by axes).

An axonometry is a projection of an object placed in the Cartesian coordinate system and its projections on any plane P taken in the given direction s along with this system[1].

The P plane is called the axonometric plane. There are two types of axonometric projections:

- right-angled axonometric projection (angle orasidagi between the projection direction s and the plane P ph = 90 °);
- axonometric projection with a curved angle (angle 0 ° <ph ° ≠ 90 ° between the projection direction s and the plane P).

One of the standard curvilinear axonometric projections is the trimetric projection, in which the coefficients of contraction of the axonometric axes vary. Textbooks, especially in Uzbek, do not cover in detail the direction of the axes using the trimming projection given in the trimetric projection or the determination of their contraction coefficients based on the direction of the given axes.

This article provides methodological guidelines on this issue. In trimetry, the coefficients of variation along the axes are not equal, that is, $K_X \neq K_Z \neq K_Y$.

In this type of right-angled axonometry, the standardized coefficients of variation along the axes are given in Table 1 ($K_X = 0.86$, $K_Y = 0.58$, $K_Z = 0.96$), which are clearly taken to make.

In this case, the sum of the squares of the given coefficients of change must be 2. In right-angled trimetry, the angles between the trimetry axes are different because the sides of the trace triangle are not equal or different from each other.

In trimetry, the values of the coefficients of variation along the axes and their square sum must be 2, and the angles between the trimetric axes can be found in Table 1.

Determine the coefficients of variation in trimetry and the direction of the axes. Figure 1, a, shows the construction of right-angled trimetric axes. Given the linear values of K_X, K_Y, K_Z in rectangular axonometry, the formula $K^2_X + K^2_Y + K^2_Z=2$ can be represented graphically (Figure 1).

To do this, we use the sections AB (e_X) and BC (e_Y) as catheters, the right triangle ABC, then the sections AC and CD (K_Z) as the catheters, and we construct the second triangle ACD. The resulting AD hypotenuse is $\sqrt{2}$.

The legs of a right-angled, equilateral triangle ADM built on the AD hypotenuse give a natural scale, ie $K_X = 0.86$, $K_Y = 0.58$, and $K_Z = 0.96$.

Rectangular axonometry is standardized for isometry, dimetry, and trimetry, while curved axonometry is standardized for frontal and horizontal isometry, frontal dimetry, and angular trimetry.

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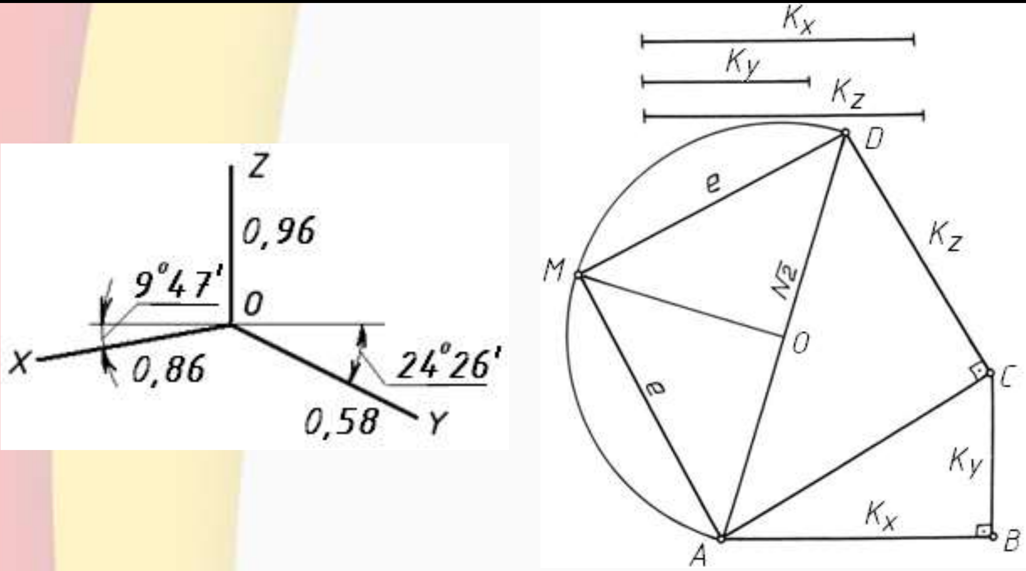
[1] Murodov Sh., Latipov L. Xolmurzayev A. Chizma geometriya. -T.: "Iqtisod-moliya", 2008, 253-bet.



a) Figure: 1 b)

The coefficients of variation of non-standardized trimetric projections on the axes can be arbitrarily selected and then the axes can be constructed or the coefficients of variation on the axes given in an arbitrary direction can be determined. The coefficients of variation cannot be chosen arbitrarily on all three axes. Only two axes are arbitrarily selected, and the third is determined analytically or by some graphical methods using the formula $K^2_X + K^2_Y + K^2_Z=2$.

1. Determine the direction of the trimetric axes with the given coefficients of change $K_X = 0.84$, $K_Y = 0.65$, $K_Z = 0.93$.

An arbitrary O' point is marked on the horizontal line. Draw a circle with the radius of the natural scale R = l = 100 centered on the point O (Figure 2). On this circle we mark points N, M, K with heights K_X, K_Y, K_Z. By connecting the point K with the point O′, we create the direction of the OZ 'axis, and the directions of the OX'OY' axes perpendicular to it.

The resulting pyramid OX'Y'Z' is cut by the plane P (P_V) axonometry to form a triangle A'B'C' traces.

Along the horizontal line, at any point, move the OZ axis perpendicular to the horizontal line and move point S 'on it to form point S.

To determine the ends A and B of the trace triangle, i.e. the direction of the axes OX and OY, passing through the height OO'1 of the pyramid O'O'B'C 'and perpendicular to the sides BC and AC intersect with planes. The resulting segments consist of right triangles. We rotate these triangles around the OO_1 axis and overlap them with the OO_1Z plane.

The result is a right-angled triangles $A'_1O'1'_1$ and $B'_1O'2'_1$ passing through points N and M. These triangles form points A'_1 and B'_1 on the axis O'_1Z '. We move these points on the OZ axis and rotate them (A_1, B_1) from the center O to the line n (the line n is the line of intersection of the axonometric plane with the coordinate plane). As a result, points A and B of the trace triangle are formed, which in turn form the axes OX and OY. The BC side of the trace triangle is at point 1 on the circle drawn in radius $O1_1$, and the AC side is at point 2 on the circle drawn in radius $O2_1$, because BC⊥OX, AC⊥OY.

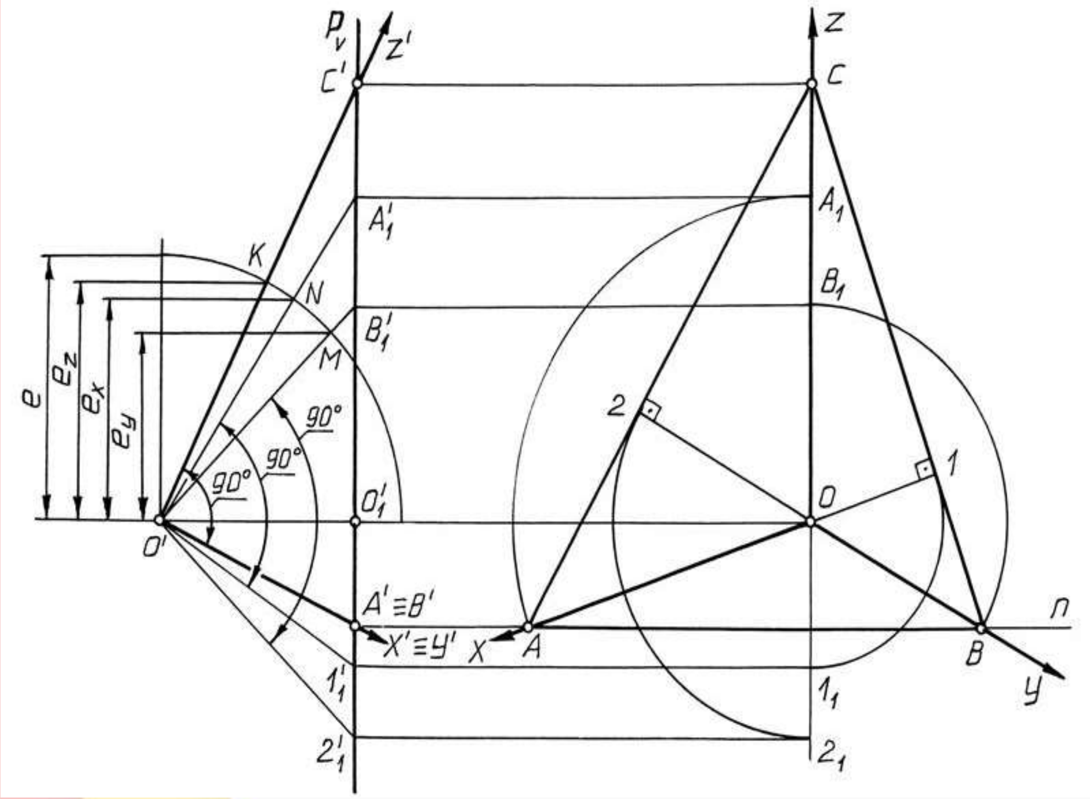


Figure: 2

2. Determine the reduction coefficients in the direction of the given axes.

In right-angled axonometry, we construct an arbitrary trace triangle ABC, assuming that the sides of the trace triangle are perpendicular to the corresponding axes (Figure 3).

OABC is a projection of a pyramid in the same plane as the system of orthogonal projections intersects the axonometric plane. The sides of the pyramid rotate the OAC, OAB, and OBC around the corresponding sides AC, AB, and BC, overlapping them with the axonometric plane. From points O_1, O_2 and O_3 to the edges of the pyramid we measure the natural scale ye = 1 and rotate them back to the axes OX, OY and OZ. As a result, we have linear values of K_X, K_Y, K_Z. Their numerical values are $K_X = 0.80$, $K_Y = 0.70$, $K_Z = 0.93$. These values satisfy the expression $K^2_X + K^2_Y + K^2_Z=2$, ie 0.802 + 0.702 + 0.932 =0.64 + 0.49 + 0.87=2.

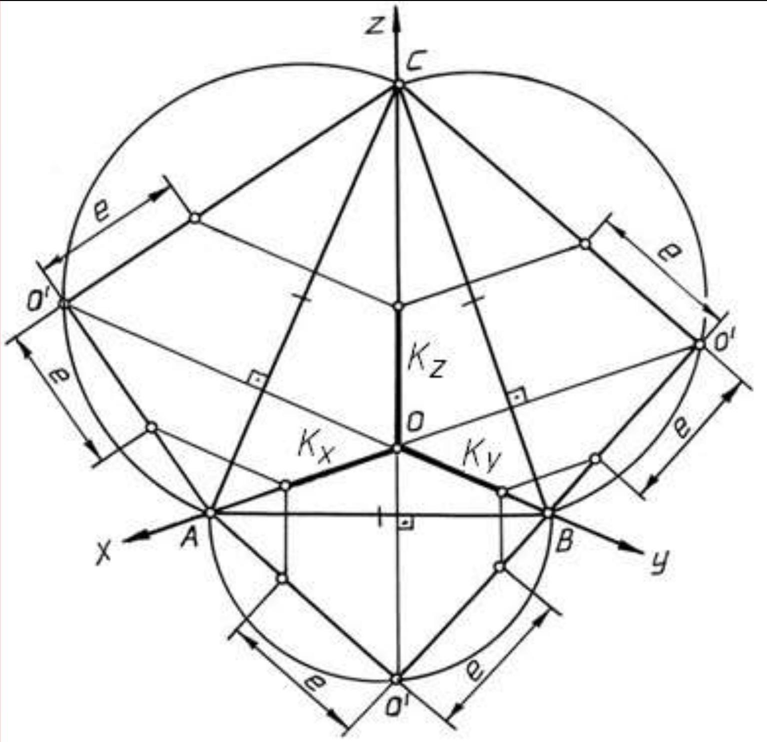


Figure: 3

Trimetric projections of the model and details can be constructed based on the above methodological recommendations. Students will be able to independently think about the direction of the axes of trimetric projection, the search for reduction factors, and develop logical thinking and problem-solving skills.

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