DETERMINATION OF THE PARAMETERS OF THE DEFAULT ISOMETRIC VIEW USING METHOD OF RECTANGULAR AUXILIARY PROJECTION

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ABSTRACT

This article describes the definition of the parameters of standard isometry using the model of rectangular auxiliary projection in a graphical way. Also improved projection apparatus of this method, so that the Z axis was in a vertical position.

Keyword: Transformations, graph, isometric, options, a diagonal of a cube orthographic projection, pictorial representation, an imaginary plane, projecting the beam, the carrier of the projection, the distortion coefficient.

INTRODUCTION, LITERATURE REVIEW AND DISCUSSION

This article describes the definition of distortion coefficients on axonometric axes X, Y, Z and angles between them of standard isometry using the transformation model-diagram of the method of rectangular auxiliary projection.

The founder of this method is a well-known Ukrainian scientist on descriptive geometry, doctor of technical Sciences Professor S. M. Kolotov [1]. The essence and content of the rectangular auxiliary projection method is as follows:

Geometric images on the Monge plot are projected on a parallel or perpendicular plane, so that these images are simultaneously projected without distortion on them and on the frontal plane of projections.

For rice.1 shows the determination of the length of a horizontally projecting straight line AB, length 100 mm, on the plane P(P_HP_V), which is depicted by thin lines, the method of rectangular projection.

For this purpose the Kolotov diagram is constructed - the device of rectangular auxiliary projection for construction of isometric projections.

Which consists of a plane P, the traces of which are located at an angle of 45° to the axis of projection, and the direction of projection s (s's'') perpendicular to it. Because in isometry, the projection direction is parallel to the diagonal of the cube.

With this direction s, the horizontal segment AB lying simultaneously on the plane P and H, is projected onto the plane V without distortion in full size A'B' =A''B_0. In this case, the point in B_0 is obtained as a result of the intersection of the arc radius A'B' and the center A' c with the front projection s '' of the projection direction s.

Through the point B_0 conducting a straight line perpendicular to κ A''B_0 we get the direction

of the projection carrier. Thus for construction of a new projection of characteristic points of objects, it is enough to find a point of intersection of each direction of the carrier of a projection of points with a line passing through them in parallel s", i.e. similarly as a point B_0.

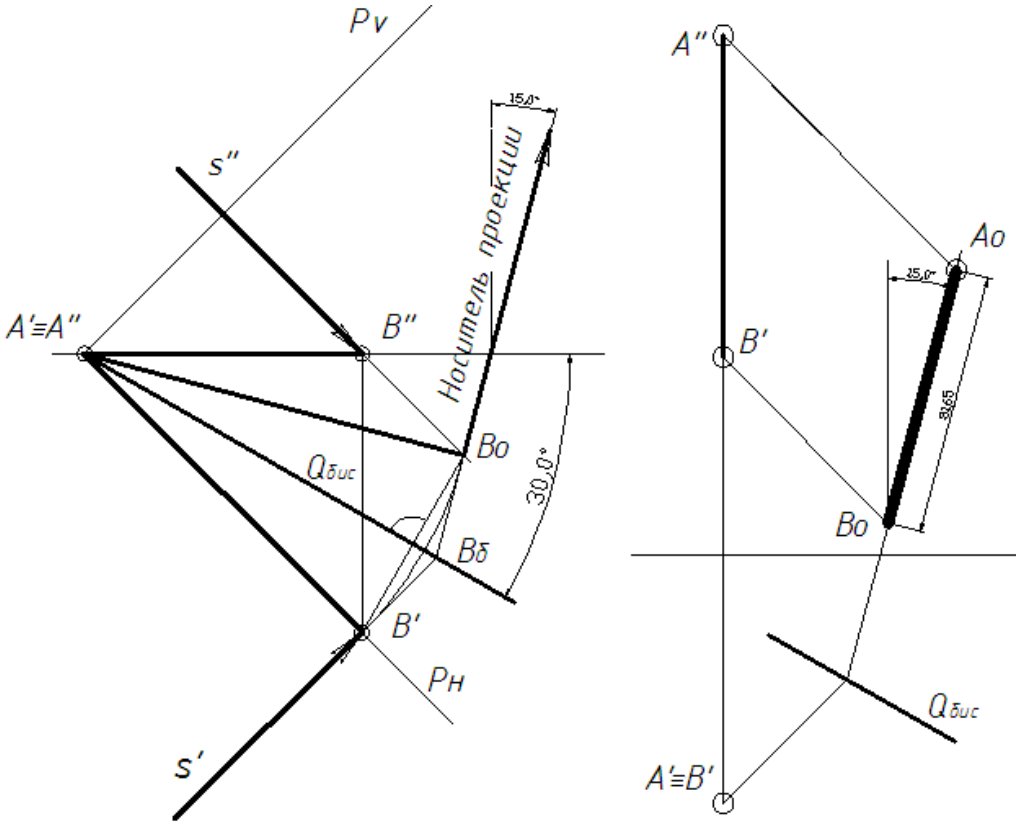

Fig.1

From the picture it can be seen that the projection carrier of this device is a reflection of the rays coinciding with the horizontal projection of the projection direction s'. Where the plane of reflection is the bisector plane of the angle B'A'B. In this case, the point B_0 can also be obtained by crossing the reflecting beam s' at the point $B_б$ lying on the bisector plane of the projection apparatus.

Thus, the elements of the apparatus of rectangular auxiliary projection of isometric projections are:

1. The projection direction s (s's") and the imaginary projection plane p perpendicular to it;
2. The bisector plane line drawn between the imaginary plane and the projection plane V;
3. A projection medium is a projection of a geometric object.

With the help of these elements of the projection apparatus we proceed to the solution of the above task:

1. Through the points A" and B" we draw parallel lines to s", i.e. the segment of the straight line AB is projected onto the plane P perpendicular to the direction s:

s' ⊥ P_H and s"⊥ P_V;

Through the points A'≡B' we draw a line that is parallel to s', as the incident line projecting to the trace of the bisector plane and reflecting from it the projection carrier;

3. New projections Ao and Bo points A and B are obtained as points of intersection of the projection carrier with parallel lines passing through points A" and B". Connecting the obtained points, we construct an isometric projection a AoBo the straight line AB.

If we imagine a horizontally projecting straight line AB as the Z axis of the Cartesian coordinate system, then the distortion of the straight line AB will be the distortion of the axis equal to 81, 65 mm.

It is known that in the method of auxiliary projection geometric images are depicted as a visual, i.e. axonometric projection. In this case, the Z axis and the faces parallel to it in the isometry are inclined 15^0 from the vertical to the right.

Having creatively analyzed these properties of the isometry constructed by the method of rectangular auxiliary projection, so that The Z axis turned out to be vertical, we decided to turn the isometry projection apparatus 15^0 to the left, i.e. counterclockwise. Where the center of rotation is taken point $A'\equiv A''=P_V\cap OX$ (axis of projections).
In this case, the elements of the isometric projection apparatus occupy the position as fig. 2:

- the P_H angle with the axis of projection of 30°;
- P_V angle with 60°projection axis;
- horizontal projection angle of projection direction s' with projection axis 60°;
- the angle of the front projection of the projection direction s" with a projection axis of 30°;
- track angle of the bisector plane with a projection axis of 15°;
- the angle of direction of the new projection carrier with the projection axis of 90°, i.e. perpendicular to the projection axis of the H/V system.

For rice. 3 shows the sequence of projection of the horizontal straight line AB on the plane P, which is perpendicular to the direction of projection s(s's"):

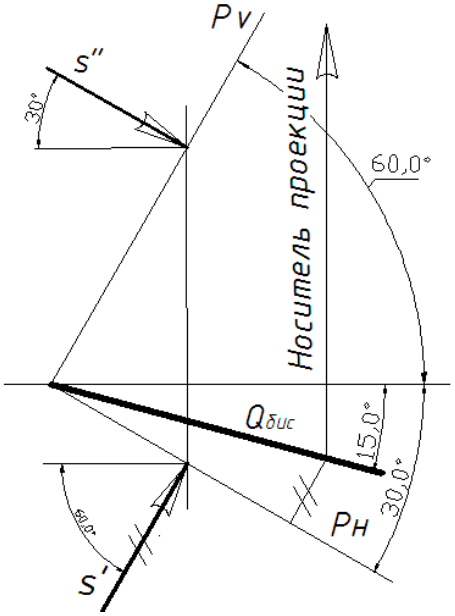

Fig. 2

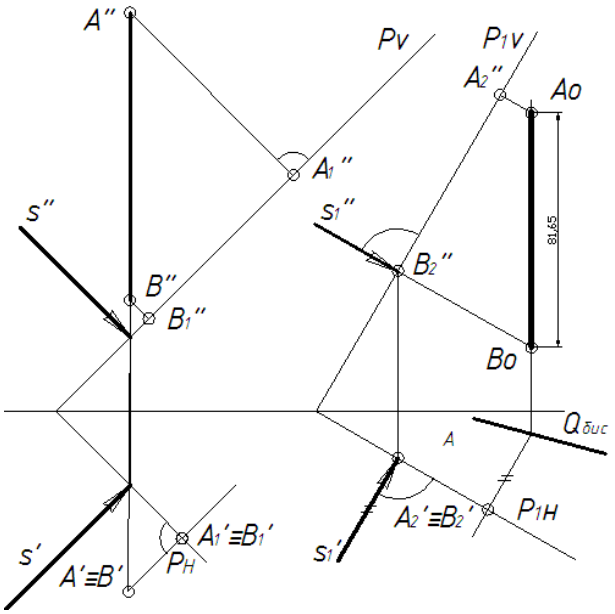

Fig. 3

1. Draw as in Fig. 3 the left elements of the projection apparatus to rotate by 15° and then: $P(P_H,P_V)$ and s(s's"), as well as $P_1(P_{1H},P_{1V})$ and $s_1(s_1's_1")$;

2. In the direction s "we project the ends of the segment on the plane P and get the points $A_2"$, B_2 and transfer them to the plane P_1;

3. Through these points, which lie on P_{1V}, we draw parallel lines to $s_1"$ and to the right we build a trace of the bisector plane of the projection apparatus so that the new projection of the line segment AoBo is built to the side;

4. And thus from the point $A_2'B_2'$ (it can be arbitrarily taken on P_{1H}) we draw a line that is parallel to s1 ' to the intersection with the trace of the bisector plane, as an incident ray.

We conduct a reflecting beam - carrier projection, which intersecting with parallel lines drawn through the points A_2" and B_2" will give the points Ao and Bo. Combining them we obtain a projection of a segment of a horizontally projecting straight line AB, as the Z axis of the Cartesian coordinate system.

Thus, improving the apparatus of the method of parallel auxiliary projection, It is possible to obtain the Z axis and parallel faces of geometric images vertically.

Using this improved apparatus in Fig. 4 and 5 the cube isometry and axonometric projections of the Cartesian coordinate system axis are constructed.

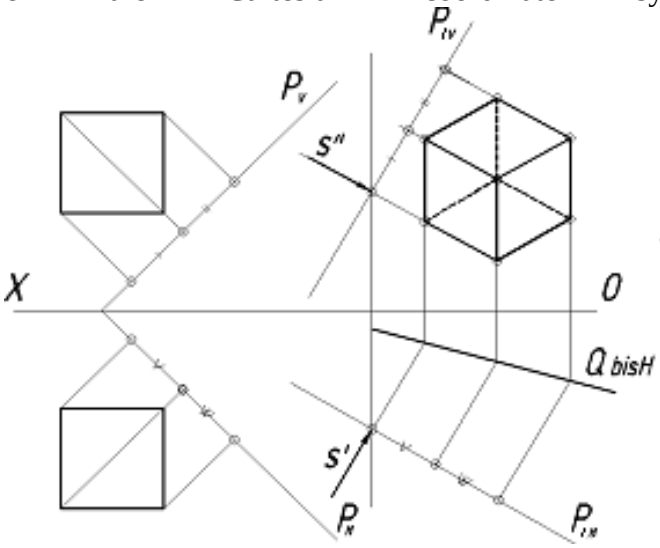

Fig. 4

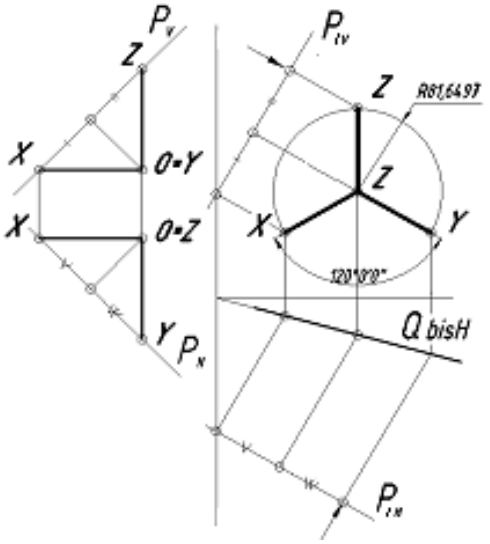

Fig. 5

The French engineer Frezier at the time of the birth of the course of descriptive geometry Gaspard Monge, and more than a century and a half later scientists Kolotov and Gordon, as well as scientists India Rana and Shah established that the orthogonal isometric projection of the cube is a regular hexagon, as in Fig. 4.

Thus, as a result of our research, we showed the possibility of graphical determination of the parameters of standard isometry using the method of rectangular auxiliary projection, i.e. distortion coefficients along the X, Y, Z axes equal to the theoretical 0.816496. And the angle between them is 120^0.

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