GALAXY INTERNATIONAL INTERDISCIPLINARY RESEARCH JOURNAL (GIIRJ)
ISSN (E): 2347-6915
Vol. 10, Issue 11, Nov. (2022)

WHEN SAYING "VISUAL IMAGE" AND "AXONOMETRY" ON HOW IMAGES ARE UNDERSTOOD

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ANNOTATION

The article emphasizes that the historical, scientific and illustra-tive material on axonometric (visual) images has a very impressive volume, when only a couple of hours of lectures and practical classes are given to study them in engineering graphics classes. The authors of the article put forward the idea of the need to rationalize the illustrative material used in the study of axonometry, the implementation of which will allow in a relatively short time to have time to pay attention to many of the main points of the object of study.

Keywords: engineering graphics, visual image, axonometry, rectangular axonometry, axonometric axes, distortion coefficients, trimetry, dimetry, isometry, oblique axonometry.

АННОТАЦИЯ

Мақолада муҳандислик графикаси дарсларида аксонометрия (яққол тасвир) лар мавзусини ўтиш учун 2 соатдан маъруза ва амалий маш-ғулот ажратилиши, лекин улар бўйича тарихий, илмий ва иллюстратив ма-териалнинг ўта катта ҳажмга эгалиги укдирилади. Мақола муаллифлари томонидан аксонометрияни тадқиқ этишда ишлатиладиган иллюстратив материални рационаллаштириш ғояси илгари сурилади ва уни амалга ошириш ҳисобига нисбатан қисқа вақт мобайнида ўрганиш объектининг кўплаб асосий жойларига эътибор ажартишга улгурилади.

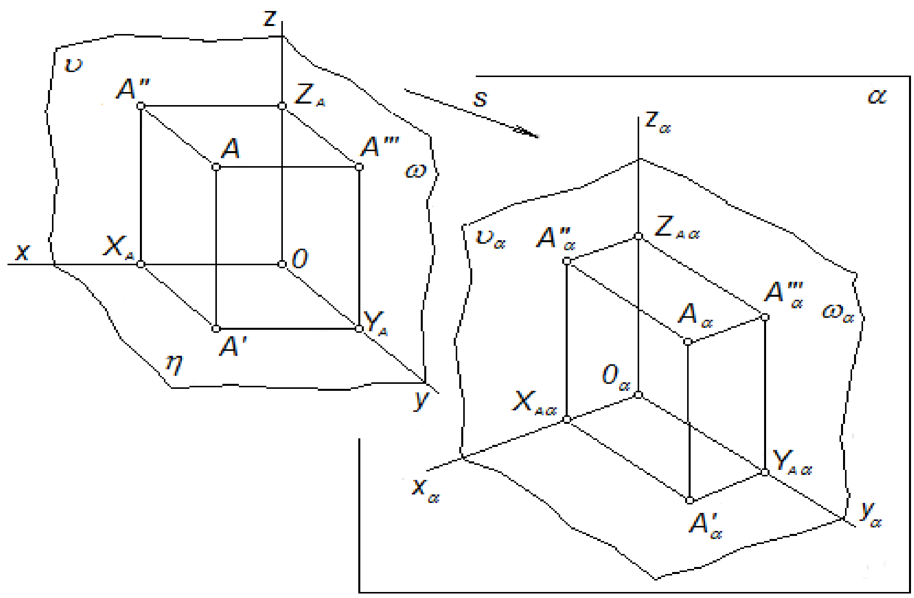
Калит сўзлар: муҳандислик графикаси, яққол тасвир, аксонометрия, тўғри бурчакли аксонометрия, аксонометрик ўқлар, ўзгариш коэффициент-лари, триметрия, диметрия, изометрия қийшиқ бурчакли аксонометрия.

АННОТАЦИЯ

В статье подчеркивается, что исторический, научный и иллюстративный материал по аксонометрическим (наглядным) изображениям обладает весьма внушительным объемом, когда для их изучения на занятиях по инженерной графике отводится всего по паре часов лекционных и практических занятий. Авторами стати выдвигается идея о необходимости ра-ционализации иллюстративного материала, применяемого при исследовании аксонометрий, реализация которой позволяет за относительно короткий срок успеть уделить внимание на многие основные моменты объекта изучения.

Ключевые слова: инженерная графика, наглядное изображение, аксоно-метрия, прямоугольная аксонометрия, аксонометрические оси, коэффициен-ты искажений, триметрия, диметрия, изометрия, косоугольная аксонометрия.

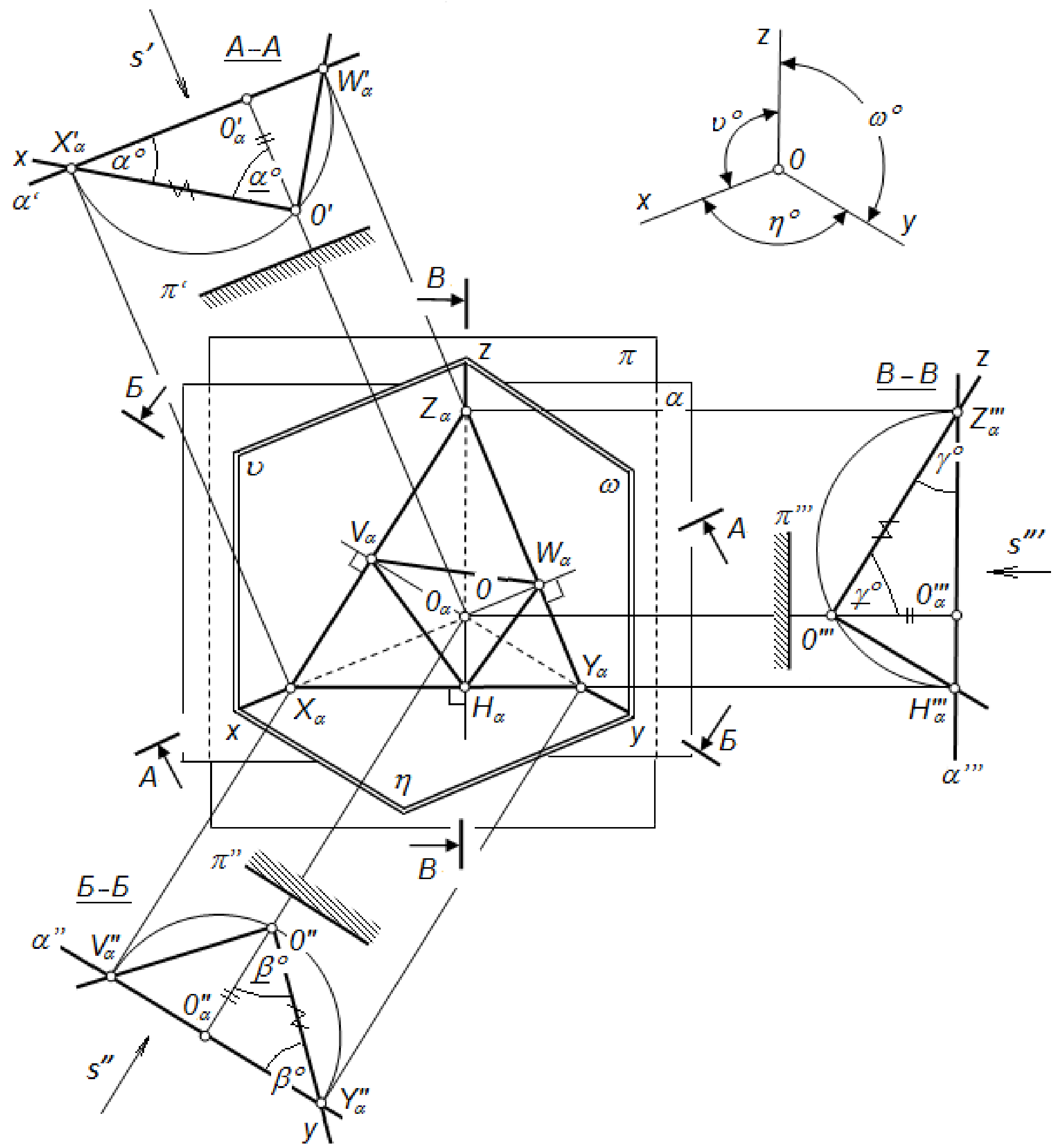
When performing various graphic operations related to drawings, the phrase "visual image" (Russian "naglyadnoe isobrazhenie" [5], English "visual imag") is often used. "Yaqqol" is a combination of Tajik words "yak" ("one") and Arabic "qawl" ("word"), meaning something like "one word together". When this expression is used in relation to an image, it is implied that the image is very similar to the object being depicted.
The closeness of the image to the depicted object is mainly ensured in such types of images as "perspective" and "axonometry". In order to think about such images, it is necessary to first have some idea about them. In this article, we made it our mission to dwell on the type of image called "axonometry".First of all, it should be noted that no matter which of the hundreds of different textbooks "Drawing geometry" we take, there is a chapter called "Axonometric projections" in the volume of 40-50 pages. From the end of the 1930s to the end of the 1980s, about 50 of the more than 300 dissertations defended in the USSR in the specialty "Drawing geometry and engineering graphics" were related to axonometric projections. 7-8% of them were doctoral dissertations [3], [6], [8].



1-picture.

We use the illustration from the source indicated as [1] in the list of used literature (Fig. 2). Based on this picture [1, p. 27], the process of explaining axonometry is carried out in the following order:
1) in the middle of a notebook page with sides of different lengths $X_\alpha Y_\alpha Z_\alpha$ draw a triangle. $X_\alpha Y_\alpha$ it is better for the side to be in a horizontal position;
2) triangle using an invisible line $X_\alpha W_\alpha$, $Y_\alpha V_\alpha$ and $Z_\alpha H_\alpha$ describe their heights;
3) one end is located at point O by means of lines drawn parallel to the heights η, υ and ω *we*

describe parallelograms. These parallelograms represent the horizontal, frontal and profile projection planes in the three-dimensional TBDK apparatus in the drawing we are drawing.
4) a piece of drawing paper to ensure that our imagination has a certain support π we describe it by separating it with a rectangle;
5) piece of drawing paper π parallel to, α describe the plane.α -can also be called the axonometric plane. This is a plain η, υ and ω intersecting with planes $X_\alpha Y_\alpha Z_\alpha$ forms the sides of a triangle. This triangle is called the triangle of traces in the theory of axonometry;
6) of the heights of the triangle of traces $0_\alpha X_\alpha$, $0_\alpha Y_\alpha$ and $0_\alpha Z_\alpha$ *parts are called axes of axonometry. They are the drawing paper plane of the 0x, 0y and 0z coordinate axes in the three-dimensional TBDK apparatus* π or axonometric ratioα in the medium of direction s perpendicular to α are projections formed on the plane. In our drawing $s \| (00_\alpha)$, or $(00_\alpha) \perp \alpha \| \pi$.



2-picture.

The result of the processes provides the following important rule: in right-angled axonometrics, the axonometric axes are located perpendicular to the sides of the triangle of traces.

We continue to make the drawing in Figure 2:

7) A – A passing through the axonometric axes and perpendicular to the axonometric plane; A-A on the basis of making additional projections by crossing B-B and V-V cutting planes; Let's describe B-B and V-V cuts. semicircles in these cuts were used to ensure that the angles between the coordinate axes and the projection planes are depicted equal to 90°

8) *We define the ratios of distance projections on axonometric axes to their actual lengths as follows.:* $|0X_\alpha|:|0'X_\alpha'|=k_x$; $|0Y_\alpha|:|0''Y_\alpha''|=k_y$; $|0Z_\alpha|:|0'''Y_\alpha'''|=k_z$; here k_x, k_y and k_z we call the values the coefficients of change along the axes of the axonometry.

In academic and scientific sources on axonometry, in the clippings in Figure 2 $\alpha°$, $\beta°$ and $\gamma°$ and on the basis of the trigonometric relations between their complementary angles to 90°, the following important rule is developed: **the sum of the squares of the coefficients of change along the axes in right-angled axonometrics is equal to 2**. $k_x^2 + k_y^2 + k_z^2 = 2$. the existence of such a relationship allows to calculate the third one if two of the change coefficients are known;

9) in the picture 2 $H_\alpha V_\alpha W_\alpha$ The triangle has names such as the triangle of bases, the triangle of transformations, and the **Weiesbach triangle**. There is a special rule related to this triangle: **in right-angled axonometrics, the bisectors of the Weissbach triangle act as axonometric axes.**

In axonometrics, between the number of the unit of length measurement on the coordinate axes e and the lengths of its images on the axonometric axes $e_x = k_x/e$; $e_y = k_y/e$ and $e_z^2 = k_z/e$ such relations are appropriate. In right-angled axonometrics, the length unit number "e" on the coordinate axes is between the lengths of its images on the axonometric axes $e = \sqrt{(e_x^2 + e_y^2 + e_z^2)/2}$ equality in the form is appropriate..

its axes aro using special formulas in right angle axonometry $\eta°$, $\vartheta°$ and $\omega°$ if the angles are known, the coefficients of change along the axesk_x, k_y and k_z or vice versa, along the axes k_x, k_y and k_z If the coefficients of change are known, the axonometry is interaxial. If the coefficients of change are known, the axonometry is interaxial $\eta°$, $\vartheta°$ and $\omega°$ angles can be determined.

Depending on the mutual ratios of the coefficients of change along the axonometric axes, axonometries can be divided into types

$k_x = k_y = k_z$ – isometry;

$k_x = k_z \neq k_y$ – dimetria;

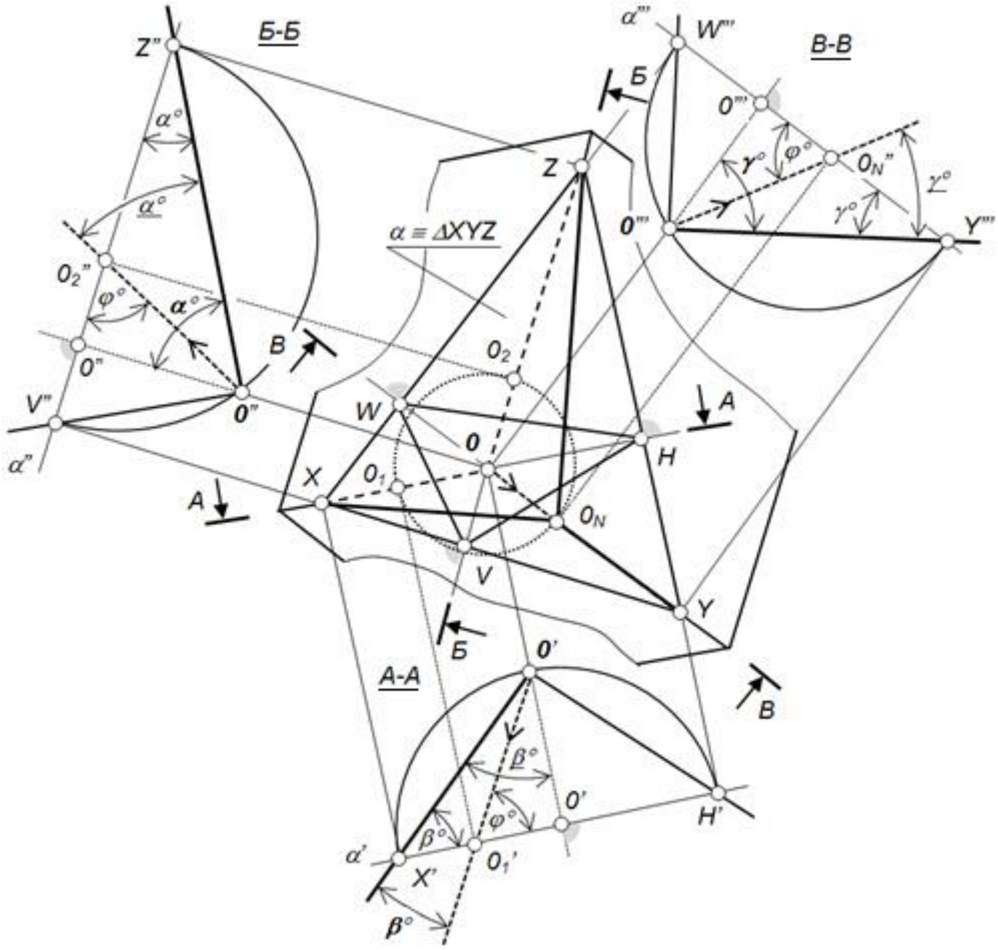
$k_x \neq k_y \neq k_z$ – trimetry.

The existence of such expressions with coefficients of change allows to determine the numbers corresponding to them. For example, characteristic of isometry $k_x = k_y = k_z$ by equality $k_x^2 + k_y^2 + k_z^2 = 2$ expression $3k_{x,y,z}^2 = 2$ can be written as and based on performing the simplest arithmetic operations$k_{x,y,z} \approx 0{,}82$ we will have the value of appearance.

If we use the number 1 instead of this value, the image will be 1.22 times larger than its original size, and such an image is called a rendered isometry. In the literature on axonometry, there is talk about ways to construct axonometries of various objects of one or another type

oblique axonometry. In Fig. 2 $s \| (00_\alpha)$ projection direction α if it is equal to an angle different from 90° to the plane, the image created based on such direction is oblique angle axonometry.

Many necessary geometrical rules related to oblique angle axonometry can be formed on the basis of the drawing in Figure 3[1, 149-б.].



3-pivture.

One such rule has the following content: ***the sum of the squares of the coefficients of change along the axis in oblique axonometrics*** $2 + ctg^2\varphi°$ is equal to, i.e $k_x^2 + k_y^2 + k_z^2 = 2 + ctg^2\varphi°$. Here φ – axonometric plane α *with* direction of projection OO_N corner between. This angle is depicted in its true dimension in all three sections **A-A, B-B** and **V-V**

In Fig. 3. and φ Depending on the shape of the angle, oblique axonometries are also divided into trimetry, dimetry and isometry. They are called **oblique-angle trimetry, oblique-angle trimetry, and oblique-angle isometry.**

According to Figure 3, passing through point 0 and α constant relative to the plane $\varphi°$ the set of lines forming an angle is at the point 0, the base α represents a circular cone located in the plane and any generator of this cone provides a satisfying solution to the equation of the sum of the squares of the coefficients of variation. But the appearance of axonometric images turns out to be different.

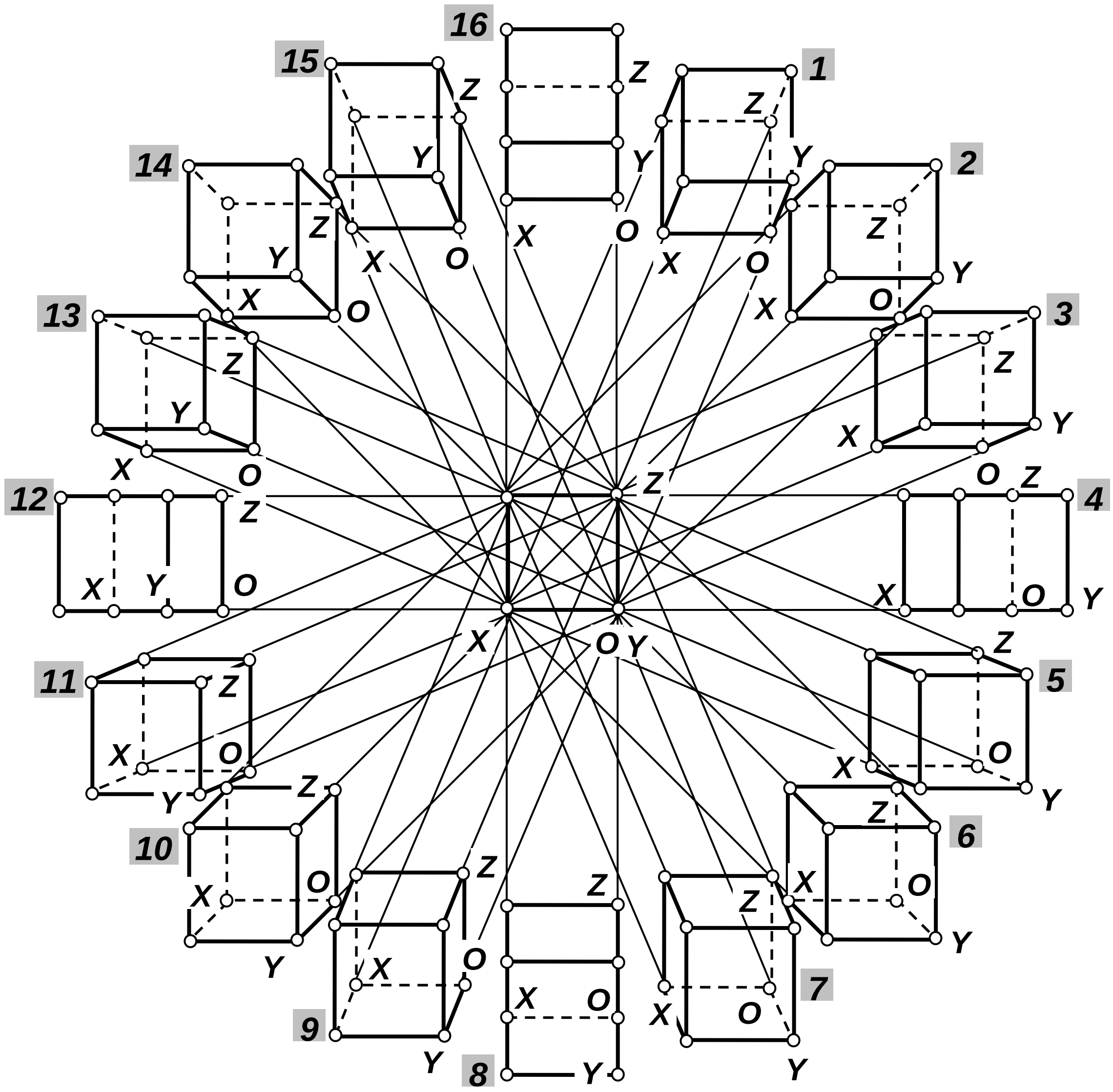


Figure 4. A variety of cubic dimetries with the same name having views.

*In Figure 4, the cube facing us with one of its sides is represented by parallel rays **φ = 63°*** are projected onto the axonometric plane (in our example, drawing paper) in different directions at an angle. when projected at such an angle, the horizontal **OX** and vertical **OZ** edges are depicted in their actual lengths, and the **OY** edge is depicted in a size equal to half of its actual length [2, p. 78]

In general, oblique dimetries and oblique isometries are images with many important properties. In the practice of engineering graphics, these types of axonometries are very widely used. For example, in the oblique frontal dimetry of the cube, the triangle **AVS** formed by its diagonals on the upper, right and front sides is an equilateral triangle and it is depicted in the actual size of its surface. in this type of dimeters, any other flat figure parallel to the plane of the triangle **AVS** is depicted in its true size [2, p. 79]

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