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ASPECTS REGARDING THE METHODS IN DESCRIPTIVE GEOMETRY

Abstract: *The paper presents some practical rules used in one of the most used method in descriptive geometry, the folding method applied for a point and a line without building the position triangle. These simple considerations can offer to the students the possibility to better understand the methods and to choose one of them without having to make complicate graphic constructions.*

Key words: *methods, descriptive geometry, folding, rotation, changing the projection plane*

1. INTRODUCTION

The purpose of this Descriptive Geometryôs method is to bring a plane figure given by projections into a projection plan or parallel to one. The result aims to measure the real value of lengths and angles. The main advantage of these methods is that you may choose any of them, and the result, or the value of the measurement will be the same.

2. CHANGING THE PROJECTION PLANES

Changing one the projection planes keeps the item in its position but one of the projecting planes will become parallel with one of the projections. Figure 1 presents the changing of the vertical projection plane for the segment (AB**)** given by its projections (ab) and (aôbô). Normally the new ground line (Ox) should be parallel with the horizontal projection (ab). We may consider the ground line through the horizontal projection (ab), and (a_1ôb_1ô) will be the new vertical projection of (AB) segment.

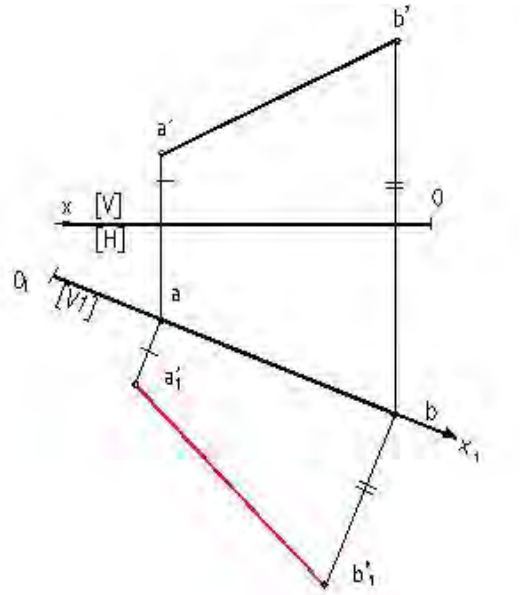

Fig.1 Changing the vertical projection plane for segment (AB)

This issue can be approached by a different angle considering the folding method for every point.

3. THE FOLDING METHOD

All geometry problems can be solved by the folding method in which all items having some position regarding projection planes may be brought in the projecting planes and measured.

3.1 Folding into the horizontal plane

Considering the point A given by its projections (a,aô) into a vertical plane [P], we turn this plane around its horizontal trace and we may obtain the new plane trace (Pv_1) and the new position of the point A_1 (figure 2).

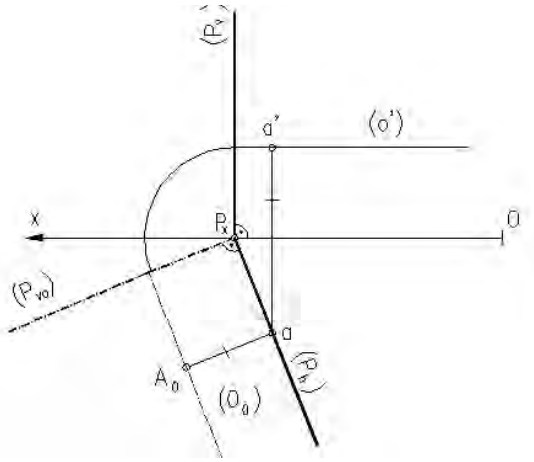

Fig.2 Folding into the horizontal plane for point A

If we apply this method for points A and B (figure3) situated on the segment (AB), we will consider the plane trace (Pv) through (aôbô) which is the horizontal projection of the segment (AB).

Analyzing now by comparison figure 1 and 3, there is no difference in the construction, only in the approach. Changing the projection plane keeps the item in its position, folding presuming a particular rotation of the item by keeping the projection planes in their position. But the main difference is regarding the projections. In the changing method, one of the item projections is not modified, only the one linked with the new plane. In the

folding method, we may not read a projection but a modified location of the point from the space.

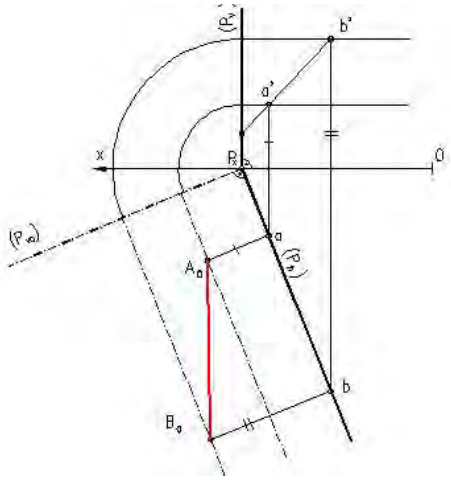

Fig.3 Folding into horizontal plane for segment (AB)

3.2 Folding for angles measurement

If we consider the (D) line given by its traces we may apply the folding into the horizontal plane (figure 4) to determine the real angle between the line (D) and the projection horizontal plane, which is angle $<(vhV_1)$.

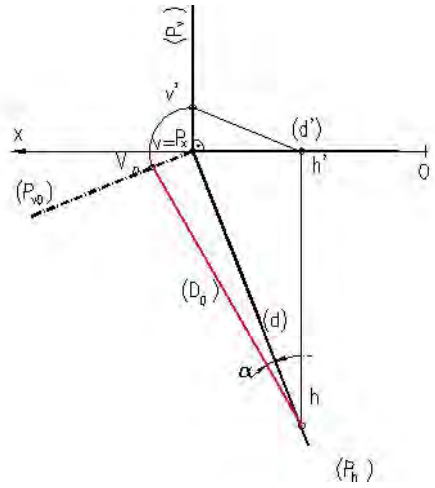

Fig.4 Folding in horizontal plane

Similar, we may apply the folding into the vertical (figure 5) to determine the real angle between the line (D) and the projection vertical plane, which is angle $<(hôvôH_1)$.

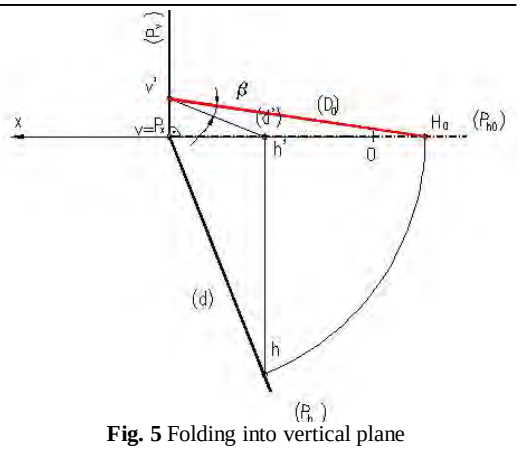

Fig. 5 Folding into vertical plane

Both these methods require the existence of an auxiliary plane, in this case the vertical plane.

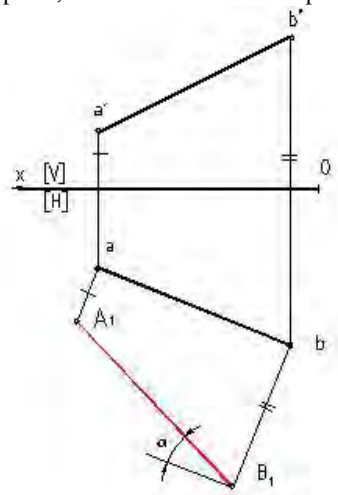

Fig.6 Angle between (AB) and horizontal plane

But finding the real value of the angle between a line and the projection planes doesnôt require auxiliary planes. In figure 6 we can measure the angle Ŭmade with the horizontal plane and ƀ (figure 7) made with the vertical projection plane.

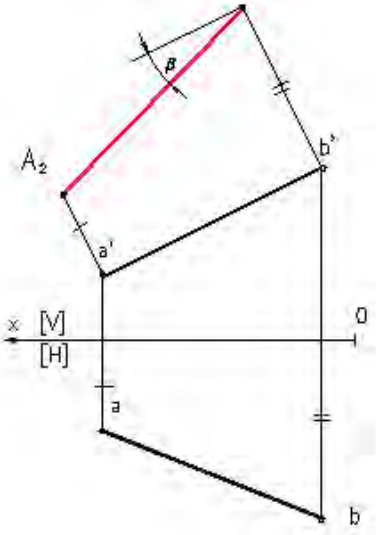

Fig.7 Angle between (AB) and vertical projection plane

The method of folding was applied for the line (AB) in case we don't know the line traces. If we know the traces we can determine the angles Ŭ and ϕ like in the figure 8.

3.3 Folding without position triangle

The definition of the folding method requires all the time a plane. A plane is folding in the horizontal or the vertical projecting plane by rotating around its horizontal or vertical trace. We may find particular constructions without folding the traces in certain cases.

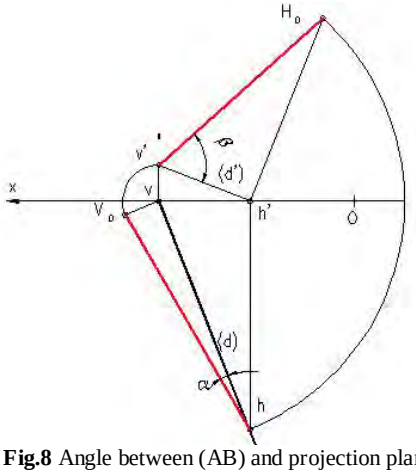

Fig.8 Angle between (AB) and projection planes

Folding for points A and B contained in plan [P] may be done in the classic way, by triangle's position, or without determine the new folded traces (figure 9). The line (AB) contained by the plan [P] is folded into the horizontal projection plane.

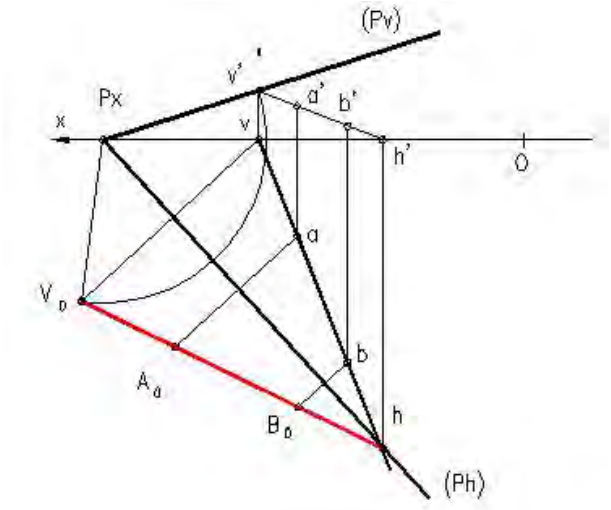

Fig.9 Folding for (AB)

3.4 Folding without planes traces

The folding method presumes by default the plan traces. Sometimes there is the possibility to apply the folding method having a line parallel with one of the projection planes. This line will be the folding axe. We may do the folding around a horizontal line because the horizontal trace of a plan is a horizontal line having elevation equal to zero. The folding into the vertical projection plane can be done with a frontal line, because the vertical trace of a plan is a frontal situated in the vertical projection plane.

Referring to figure 9, the trace (P_h) of the plan [P] is and horizontal line of the plan. It was very simple to find point A_0.

Using a similar method it is considered a certain horizontal line (O) and the point A given by projections. Figure 10 presents the folding around line (O).

$$a\hat{o}n\hat{o} = aa_1 \quad (1)$$

$$ma_1 = mA_0 \quad (2)$$

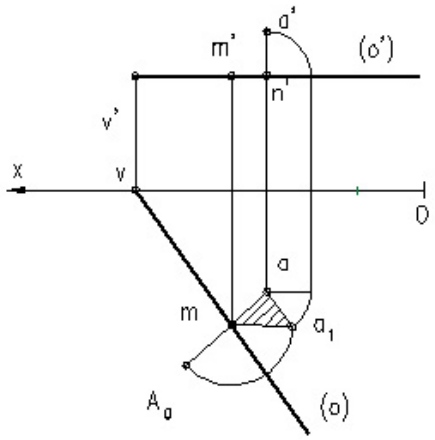

Fig.10 Folding around a horizontal line

It can also be done by folding around a frontal (F) line (figure 11).

$$an = a\hat{a}a_1\hat{o} \quad (3)$$

$$m\hat{a}a_1\hat{o} = m\hat{o}A_0 \quad (4)$$

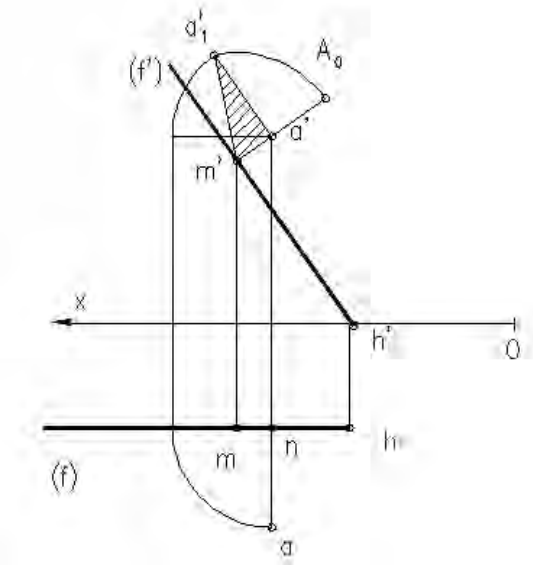

Fig.11 Folding around a frontal line

The ground line is not properly used in the last two examples. Descriptive geometry uses the ground line to measure the coordination of the points. But in the last representation the distance and the elevation of point A were not counted because the projection planes were not interesting. The traces of the horizontal line and the frontal one were represented but they do not have any relevance in the subject.

4. ROTATION

Angle measurement can be done even with the rotation method.

In figure 12 the segment (AB) is rotated until becomes parallel with the vertical projection plane. It can be measured the real length of the segment (ab_1) and the angle made with the vertical projection plane ϕ.

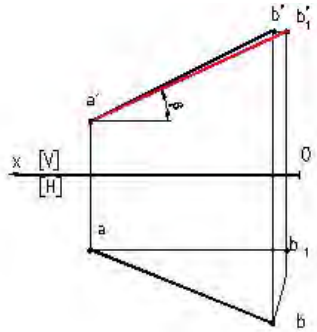

Fig.12 Angle between (AB) and vertical projection plane with rotation method

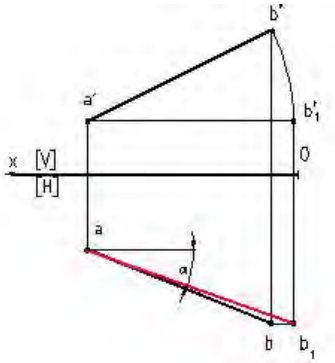

Fig.13 Angle between (AB) and horizontal plane with rotation method

In the same way we can rotate the segment (AB) until becomes parallel with the horizontal plane (figure 13). We can measure the real length of the segment (ab_1) and the angle made with the horizontal plane Ü.

5. CONCLUSIONS

The paper presents a couple of simple intuitive methods that can be used by the students during the classes. Stepping forward the complexity of these methods, geometrical transformation provides graphic instruments used to solve space problems, understand special objects from given principal views. Students get an impression regarding abstraction of the large variety of geometric shapes, and of geometric reasoning. These intellectual abilities are very important for engineering studies, mainly in the first year of study.

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