THE ANALYSIS OF THE PROCEDURES OF GRAPHICAL SOLVING OF THE INTERSECTION POLYHEDRON-ANY STRAIGHT LINE

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Abstract: *This paper deals with relation between a polyhedron of particular position and any straight line; the graphical solving consists of an artifice based on the methods of descriptive geometry; we con get the same solution applying two different methods*

Keywords: *polyhedron, intersection*

1. INTRODUCTION

Right from the beginning, the paper makes use of a procedure which can lead to graphical development and finally to finding the intersection points between the polyhedron and the straight line.

This procedure consists in performing the rotation of one geometrical element which leads to the graphical development of the theme presented by this paper.

2. CONTENTS

Here are the initial problem data: a straight rectangular prism whose base is included in the horizontal projection plane *[H]* and a straight line of any position *D(d, d');* the polyhedron lies in a particular position and the coordinates of its points are fixed: *ABCDEFGH* (*abcdefgh, a'b'c'd'e'f'g'h'*) as shown in figure 1.

The classical method used in such cases, can be applied only after the polyhedron is brought in an advantageous position to the vertical projection plane [V]; thus we perform a rotation – to the vertical plane [V] – of the diagonal line *AH* (the projection *a'h*) until it becomes perpendicular to *Ox* in the point a'' was performed round the axle I (I, I'*), a' = i' =*a_1*';* the other points rotate with the some angle so that the edges of the prism have become frontal straight lines; so here are the new projections of the prism: $a_1b_1c_1d_1e_1f_1g_1h_1$ in the plane [H] and $a'b_1'c_1'd_1'e_1'f_1'g_1'h_1'$ respectively in the plane [V] [1]. Now we are in a position to perform the actual intersection between the prism and the straight line; two procedures are taken into account:

a. By using an auxiliary plane, namely the plane [R] (perpendicular to [V]), whose vertical mark *R'Rx* intersects the edges of the prism, we get the projections *1'2'3'4'* which belong to [V] and 1234 respectively which belong to [H]; these projections belong to the section polygon.

The straight line *D (d, d')* intersects the polygon in the points *K (K, K')* and *L (l, l')* as shown in figure 2**.**

The visibility of the straight line which crosses the prism is provided by means of already known rules [2].

b. The second procedure consists in using a plane [Q] parallel with the lateral edges of the prism; thus a plane parallel with the edges of the prism was drawn through the straight line D: we choose a point *S(s, s')* on the straight line D through which we draw the straight line D_1 parallel with the projections of the edges of the prism – $d_1 // a_1c_1$, $d_1' // a_1'c_1'$.

These two straight lines D_1 and D_2 concurrent in the points S, so the projections d and d_1 concurrent in s give rise to the horizontal mark Q of the plane [Q] by means of the horizontal marks K_1(k, k') and K_2(k_1, k_1').[3]

We use the auxiliary planes [R]… [R_n] which go through the edges of the prism $C_1H_1…A_1E_1$ which intersect the projections of the edges in the horizontal plane [H]: for example *R1'* includes $C_1'h_1'$ [4]; thus we determine the points of the section polygon between the plane [Q] and the prism, $A_2B_2C_2D_2$ ($a_2b_2c_2d_2$, $a_2'b_2'c_2'd_2'$).

3. CONCLUSION

The projection in *[H]* $a_2b_2c_2d_2$ – intersects with the mark Q of the plane [V] by means of the projection points $K_1'l_1'$.

We con state that by means of another solving procedure [5], we have found the same intersection points of any straight line *D(d, d')* with the given prism, namely $K_1'l_1' = K'l'$ as shown in figure 2.

These graphical developments based on two different methods which lead to the same solution prove the scientific rigors of the principles descriptive geometry is based on.

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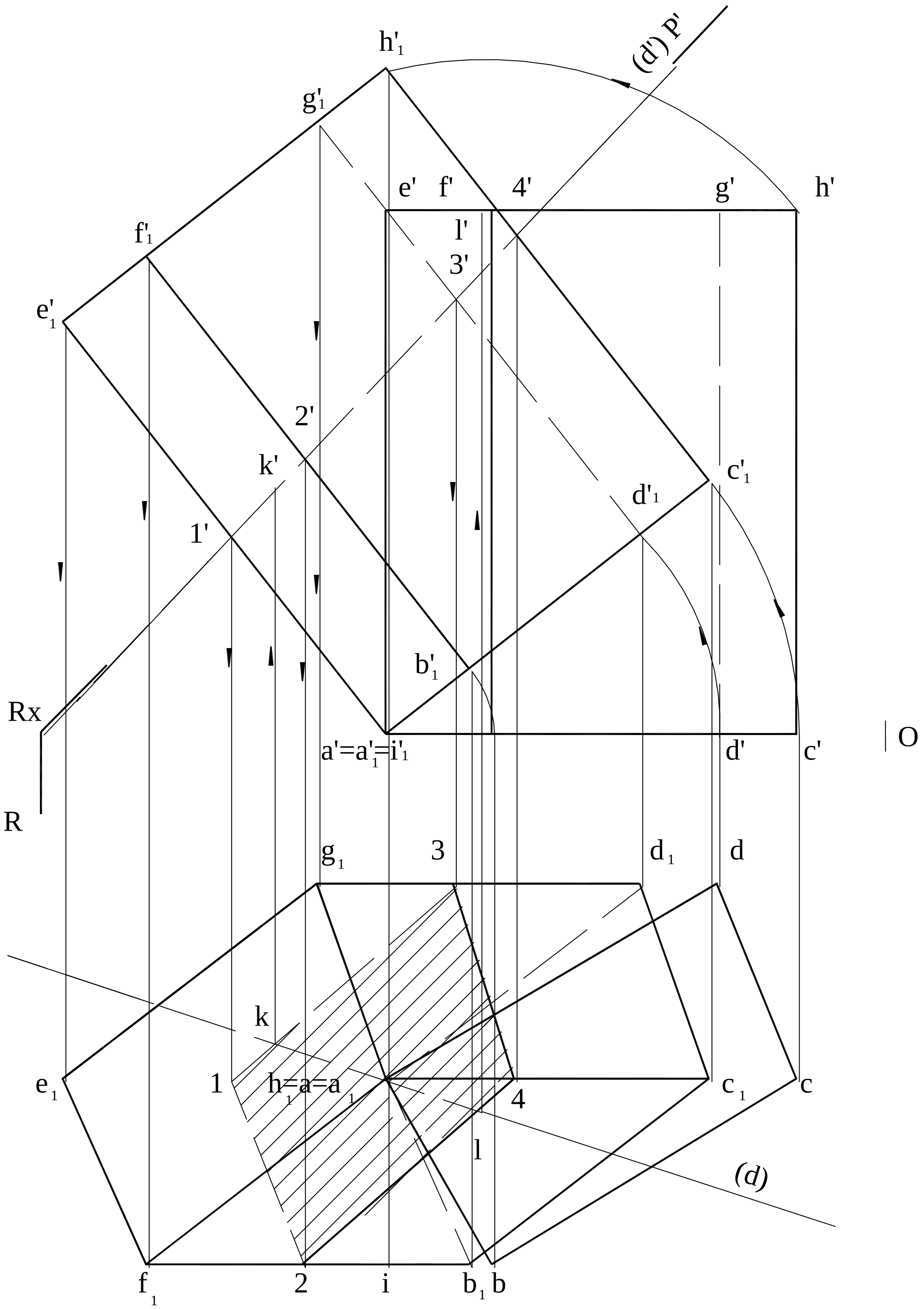
h'1
g'1
(d') P'
e'
f'
4'
g'
h'
l'
3'
f'1
e'1
2'
k'
c'1
d'1
1'
b'1
Rx
a'=a'1=i'1
d'
c'
O
R
g1
3
d1
d
k
e1
1
h1=a=a1
4
c1
c
l
(d)
f1
2
i
b1 b

Fig. 1

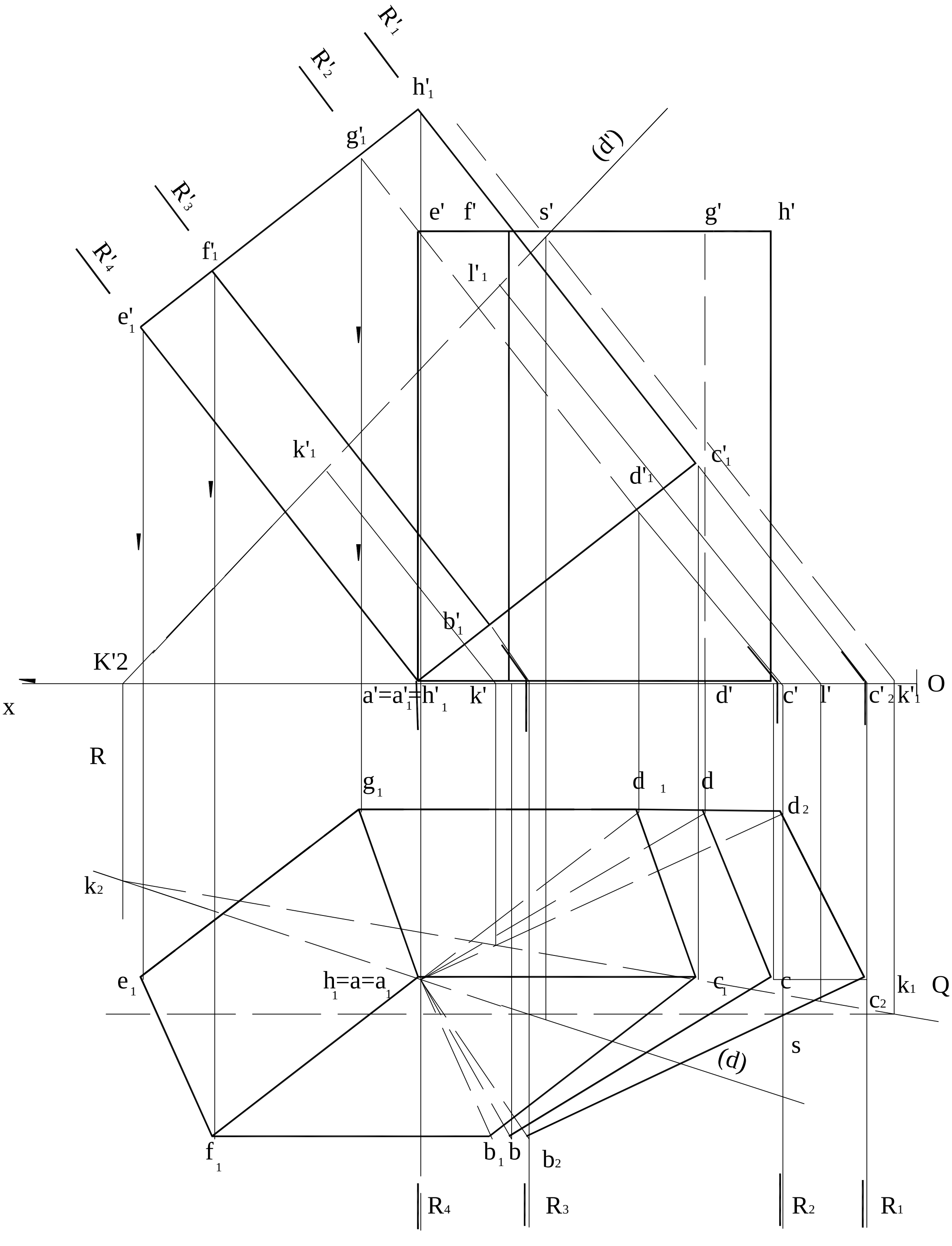

Fig.2

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