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SOME CONSIDERATIONS REGARDING THE APPLICATION OF THEORY IN PROBLEM SOLVING SPATIAL PROJECTION OF SIMPLE OBJECTS

Abstract: *This paper highlights how the knowledge of descriptive geometry could be interconnected with using Microsoft Office programs in order to develop the educational materials. Also, it can be deduced that the graphical representation using these programs requires both rigor and precision, if it is desired an accurate and challenging Microsoft PowerPoint presentation having the aim to generate a huge interest from students.*
The better understanding of the Descriptive Geometry and Technical Drawing subject fully depends by the quality of the educational process, the materials, the methods and the tools used by the professor.

Key words: *dihedral, trihedral, planar representation, isometric axonometric representation*

1. INTRODUCTION

This paper presents the advantages of using Microsoft Office Power Point in the education process of the Descriptive Geometry and Technical Drawing for the students from the first year of study. It has to be mentioned that, in the beginning of their studies, due to the new position, as students, with many unknowns strewn on the path they have chosen, in order to obtain the desired title of diplomat engineer, these students are very tense, like pre-tensioned springs.

As a professor of Descriptive Geometry, in the case of classical teaching at blackboard with chalk and sponge, very often could be heard the students worried muttering: "Oh, how difficult it is! I donœt like it!ò. In the fact, all of us are saying that we do not like something when we do not understand that thing. In addition, the Descriptive Geometry and Technical Drawing subjects are too important in the educational process of the future engineers, so the quality of teaching of these subjects should not be neglected.

So, I started to execute the graphic representations using Microsoft Word Drawing Tools and transposing them into PowerPoint Show presentations. The results consisted in a valuable teaching material that, used in combination with traditional teaching process, help to trigger the imagination of students. These gave them the ability to "see in space" and to make exclamations like: "Yes! That's it! I understand it! I love it!". This reaction is the main reason to stimulate their creativity, to encourage them to represent their ideas and technical concepts assisted by the ñlanguageò of Technical Drawing, whose "grammar" is exactly the Descriptive Geometry.

It is possible that the figures presented in this paper to seem loaded by lines, arcs, arrows, and notations. It has to be mentioned that all figures are executed using Microsoft Word Drawing Tools and represents captures from Power Point presentations. All information are presented to students in logical and chronological order using the Custom Animation tools. It should be said that only the Professor of Descriptive Geometry subject knows how much knowledge, time and energy are needed to elaborate such material.

2. THEORETICAL CONSIDERATIONS

Descartes said that the SIZE OF A SPACE represents the number of coordinates required for a clearly defining of the position of a point in that space.

Based on this definition, it could be said that the point is a space without dimensions, the line is a space with one dimension, the plane is an area with two dimensions, and what is commonly called OBJECT is a space with three dimensions (length, width and height).

The assembly of methods and means used to make the transition from a space with a number of dimensions in a space with a different number of dimensions is called PROJECTION SYSTEM.

In order to obtain of the orthogonal plan projection of a point from space, the rules and the conventions established by recognized international bodies are applied.

The understanding and applying of the knowledge related to principles and conventions of the plane graphic representation for a point in space, by the students, it is imperative.

3. PARTICULAR CASES

The vertical plane of projection, *[V]*, is considered stationary. The horizontal plane of projection, *[H]* and the lateral plane of the projection, *[L]*, will be rotated around the axes *ox*, and *oz*, respectively, in the opening sense of the trihedral *I*, to overlap with *[V]*.

Thus the plane representation in two projections, and three projections, respectively, of a point placed in a certain dihedral/trihedral is obtained.

In each figure the trajectories executed by each mobile projection plan and the images contained therein are given.

In the figure *1 a)* it is illustrated the rotation of the plan *[H]* around the *ox*-axis until overlapping with the plan *[V]*.

In the figure *1 b)* it is shown the result of this rotations, namely the plane representation in two projections of the point *M (m, m ')*, located in the first dihedral, *DI*.

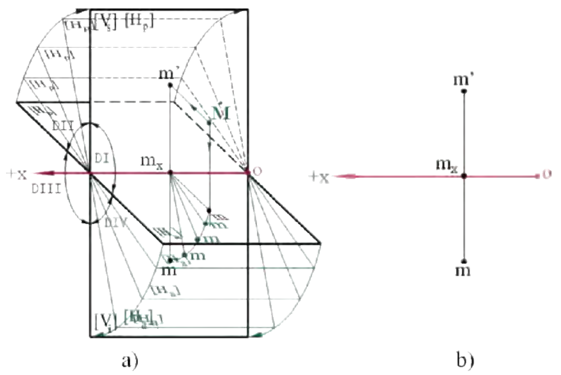

Fig. 1 a) Rotation of plane of projection *[H]*; b) Representation in two projections of point *M* located in *DI*

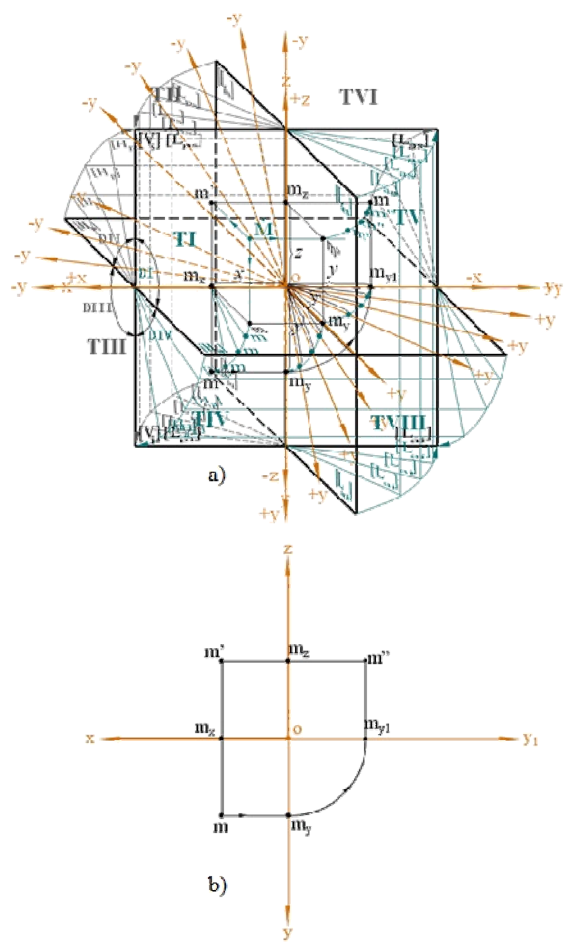

Fig. 2 a) Rotation of planes of projection *[H]* and *[L]*; b) Representation in three projections of the point *M* located in *TI*

In the figure *2 a)* it is presented the rotation of the plan *[H]* around the *ox*-axis and of the plan *[L]* until overlapping with the plan *[V]*.

In the figure *2 b)* it is illustrated the result of this rotations, namely the plane representation in three projections of a point, *M(m,m',m")*, located in the first trihedral, *TI*, with all positive coordinates, *M(+x,+y,+z)*.

In the figure 3 it is considered the point *N* located in the trihedral II, *TII*, for that it is applied the known representation principles in order to obtain in three projections the plane representation of the point *N(n,n',n")*, with one negative and two positive coordinates, *N(+x,-y,+z)*.

In the figure 4 the point *R* is situated in trihedral III, *TIII*, with one positive and two negative coordinates, *R(+x,-y,-z)*, for which it is presented the necessary rotations of the horizontal planes and the side planes in order to obtain the plane representation. In the figure 5 there are presented the rotations of horizontal and lateral planes of projection in order to obtain the plane representation of the point *P(p,p',p")*, which is located in trihedral IV, *TIV*, having two positive and one negative coordinates, *P(+x,+y,-z)*.

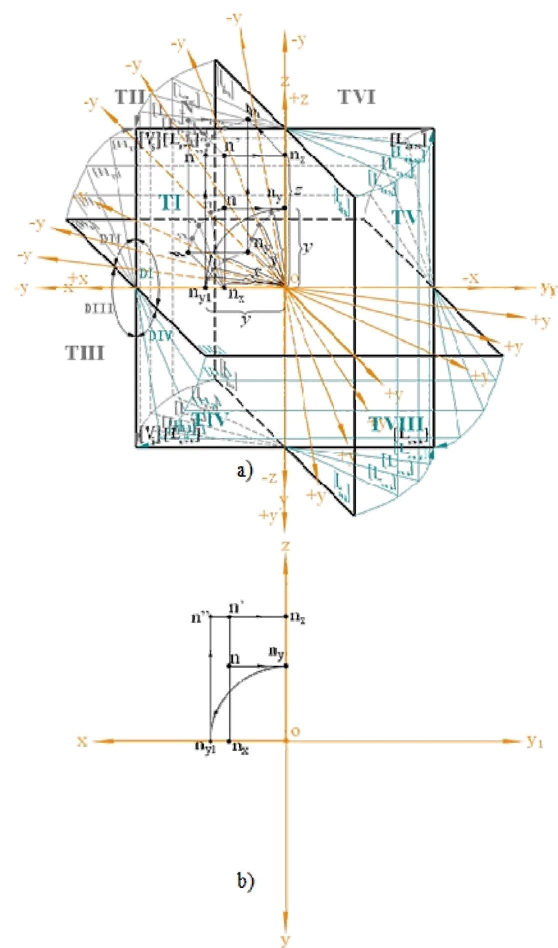

Fig. 3 a) Rotation of planes of projection *[H]* and *[L]*; b) Representation in three projections of the point *N* placed in *TII*

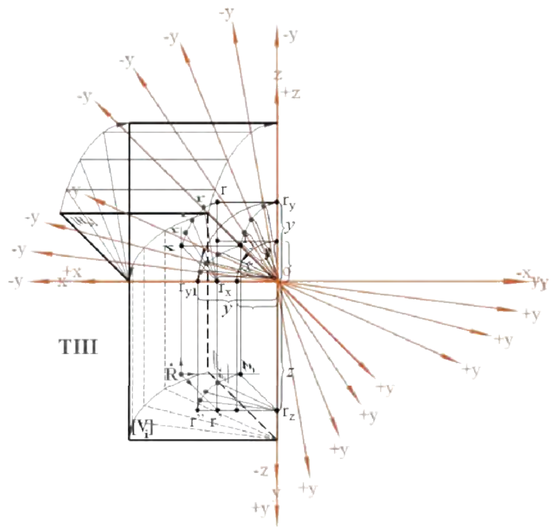

Fig. 4 Rotation of planes of projection *[H]* and *[L]* in order to obtain the representation of point *R* from *TIII* in three projections

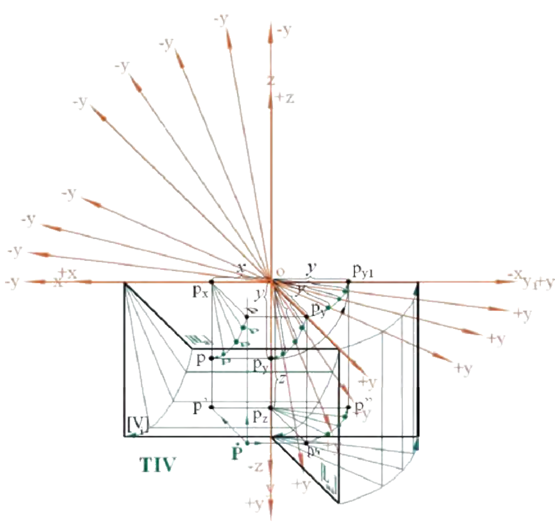

Fig. 5 Rotation of planes of projection *[H]* and *[L]* for obtaining the representation of point *P* located in *TIV* in three projections

An accurate representation of the point leads to easily representation of a straight, a plan and an object from the space taking into account that for representation of a line are required two points (figures 6 and 7); for representation of a plane there are necessary three-points (or two parallel/concurrent straights, or a line and a point). The objects represent combinations of these elements: straights (edges), planes (sides), and points (peaks) [1].

In the figures 8, 9, 10 and 11 there are presented practical application models for students [2], [3]. Together with the teacher or throughout self-study, as homework, they has to build isometric axonometric image of the object according to given plane representation, as well as, they have to determine the third plane projection having two of them and they have to represent the axonometric isometric representation of object.

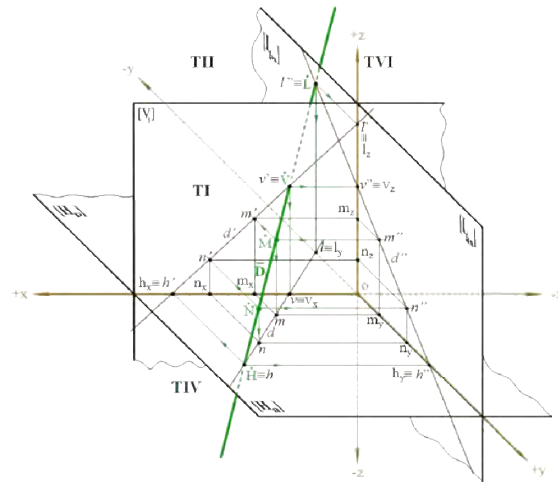

Fig. 6 Axonometric representation of the line determined by the points *M* and *N* situated in *TI*

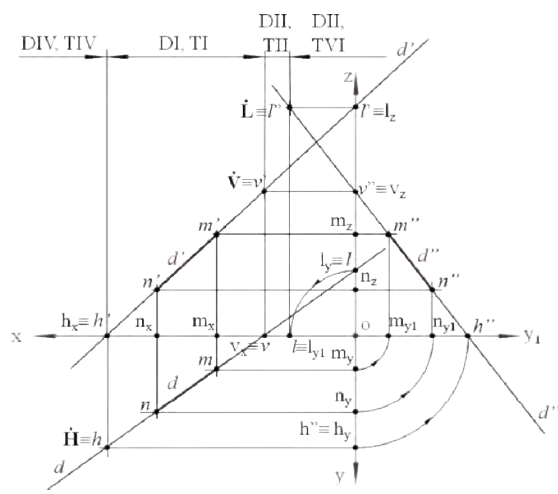

Fig. 7 Representation in three projections of the straight from figure 6 and spaces regions through passed it

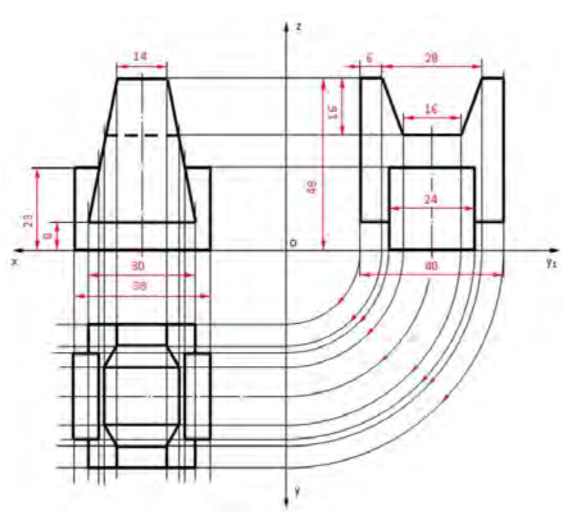

Fig. 8 Representation in three projections of an object from *TI*

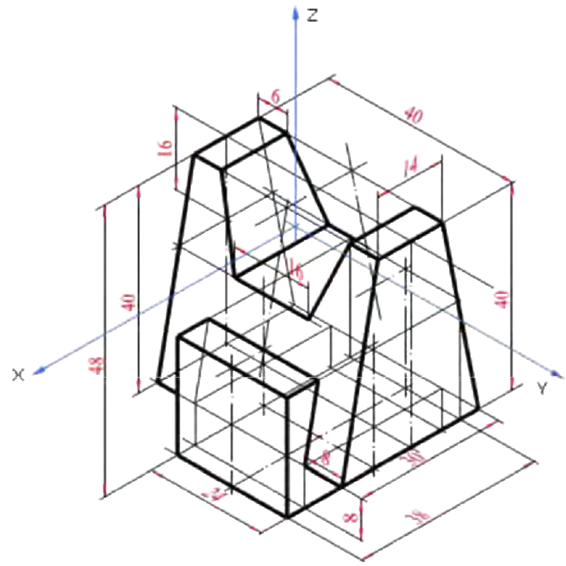

Fig. 9 Isometric axonometric representation of the object from figure 8

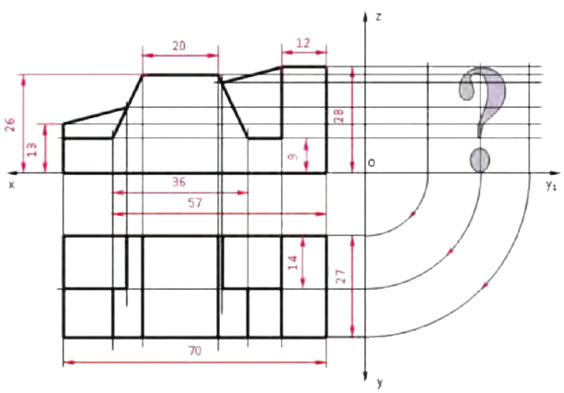

Fig. 10 Representation in two projections of an object from *TI*

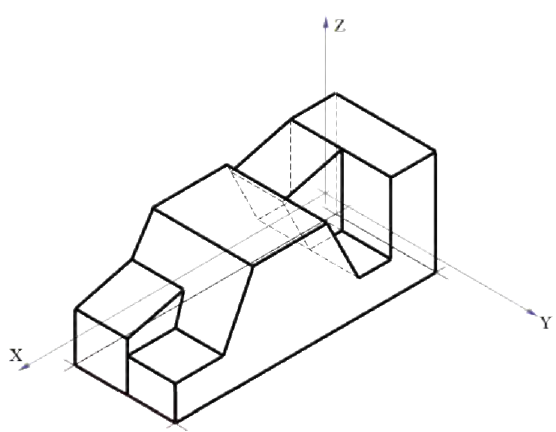

Fig. 11 Isometric axonometric representation of the object from figure 10

4. CONCLUSIONS

The applying of modern methods of teaching and learning in the educational process of students, leads to creation of "space vision" and the training skills of plane graphic and axonometric representation of ideas, and technical concepts of the future specialists in engineering sciences.

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