ISSN 2255-2316

BASIC SURFACES FOR ENGINEERING

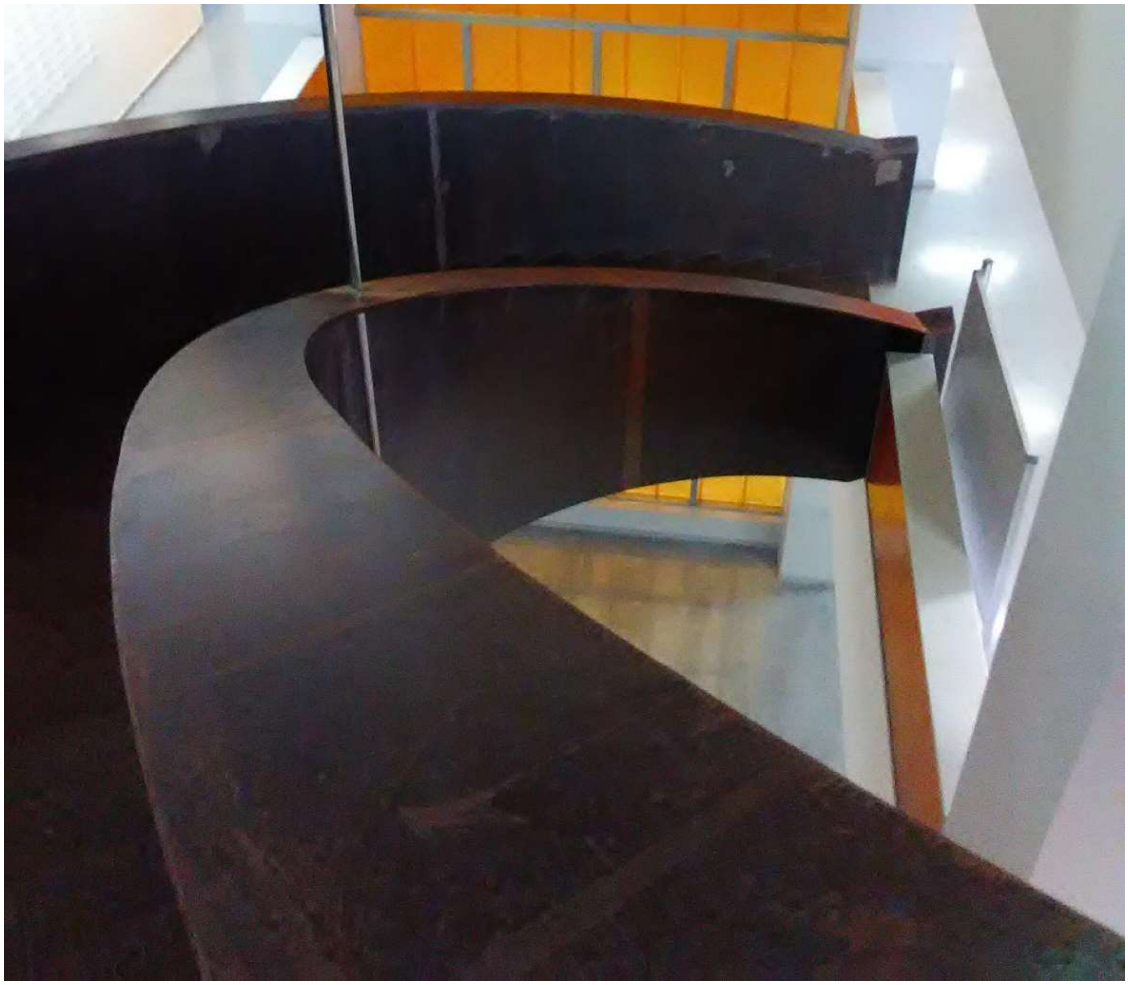

Figure 00. Main stairs of Engineering School of Bilbao II. Picture made by the authors, 2018.

2. Representation of the surfaces

Content

2. Representation of the surfaces

At the end of this topic, it is expected that the students will be able to:

- To define and to identify basic surfaces, and to know the nomenclature.
- To represent basic surfaces, both in favourable and non-favorable positions.
- To locate one point on the surface.

For an adequate follow-up of this topic it is necessary to have achieved the skills from previous learning topics:

- Dihedral System: Single and double auxiliary projections.

2.1. Apparent contour representation

Surfaces are represented by the projections of their apparent contour, adding the edges. In order to make interpretation easier, visible and hidden parts must be visualized.

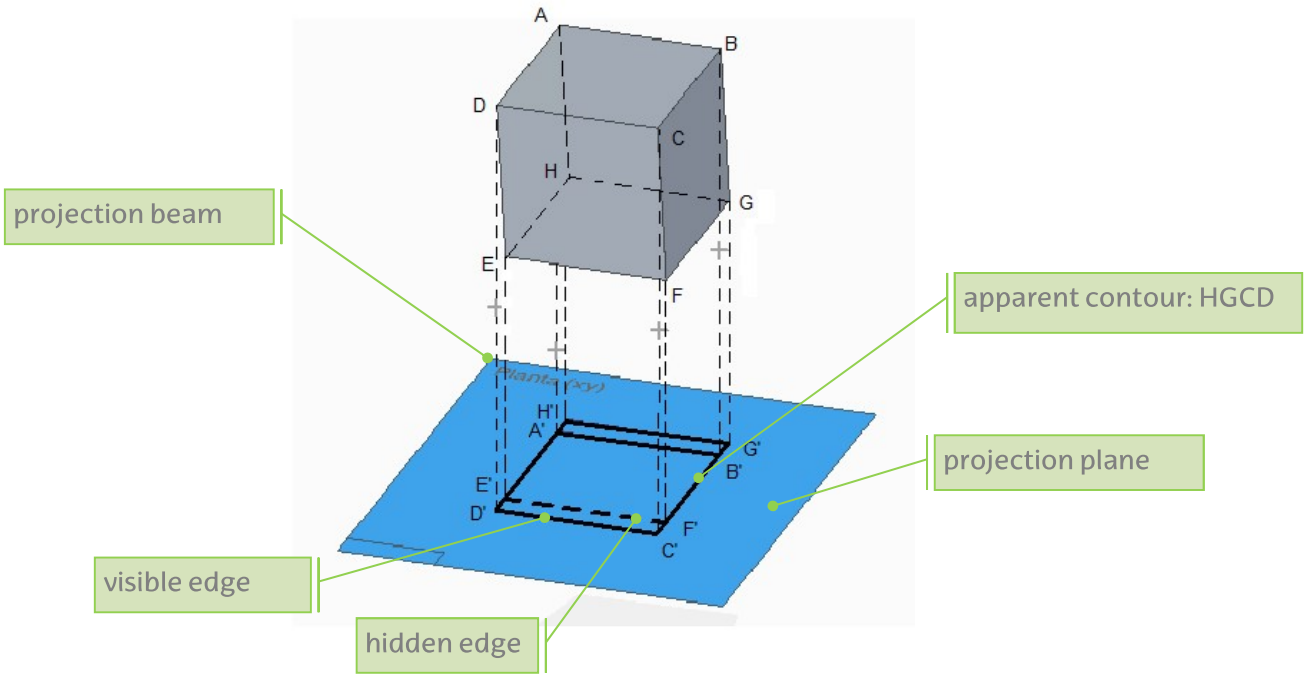

Figure 2. 1. Apparent contour projection, and visible and hidden parts visualization (Image made with Solid Edge).

Apparent contour in each projection is found by connecting the intersection points of the infinite projection beams tangent to the surface with the projection plane. (Figure 2.1).

The line of the apparent contour divides the surface in two regions. The region closest to the observer is visible, and the farther one is hidden. The visualization must be analysed in each of the views where the surface is projected. (Figure 2.2)

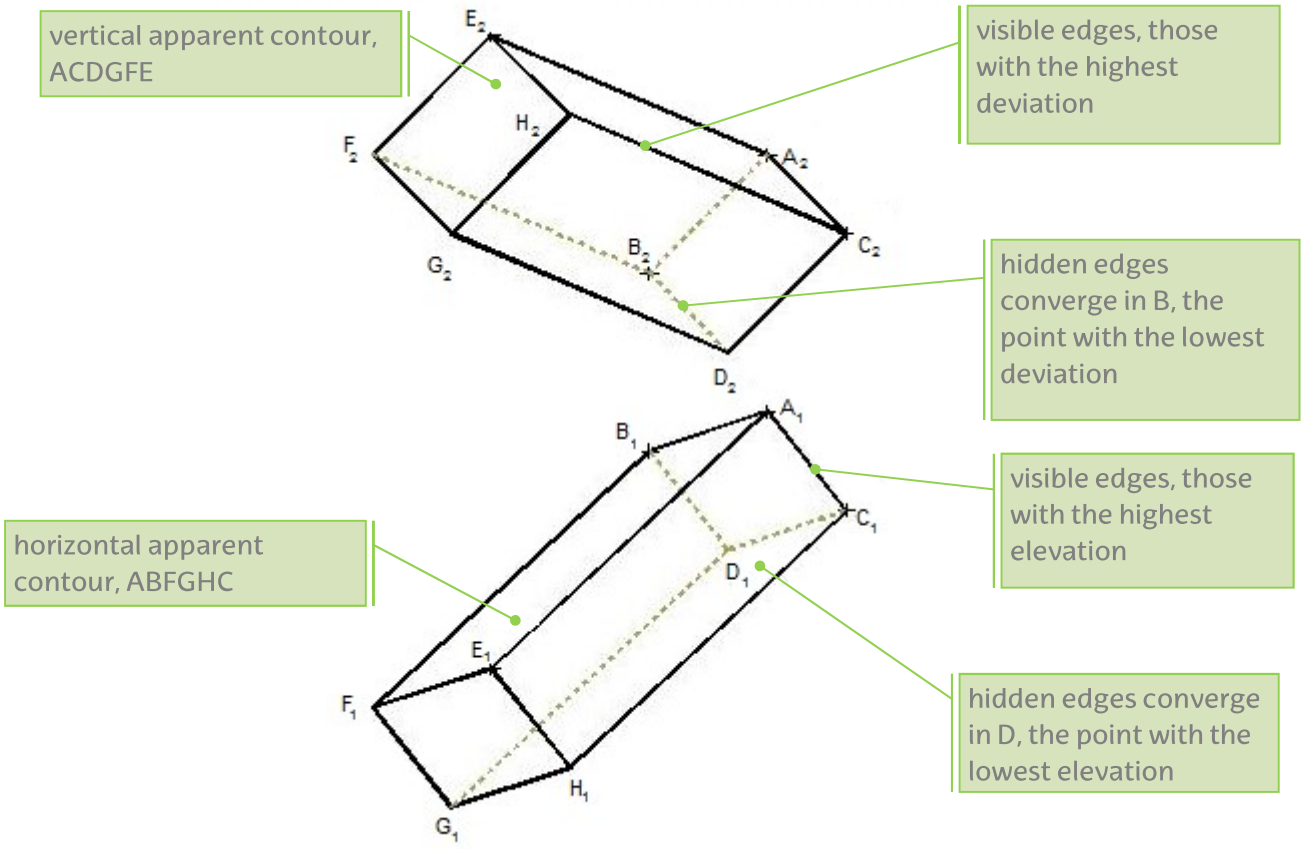

Figure 2. 2. Visible and hidden parts of an oblique prism, depending on the position with respect to the observer. (Image made with Solid Edge).

2.2. Representation by means of the generatrix and guideline

Surfaces of great dimensions can be defined by means of their generatrix and guideline. In this case, the surface itself is not represented, but we have the data to represent it.

Ruled surfaces (generated by a line) are unlimited, therefore, only a part can be represented. Pyramidal and conical surfaces are generally represented with the part between the vertex and the guideline plane. (Figures 2.3 and 2.4). Prismatic and cylindrical surfaces are generally represented with the part of the surface between two plans.

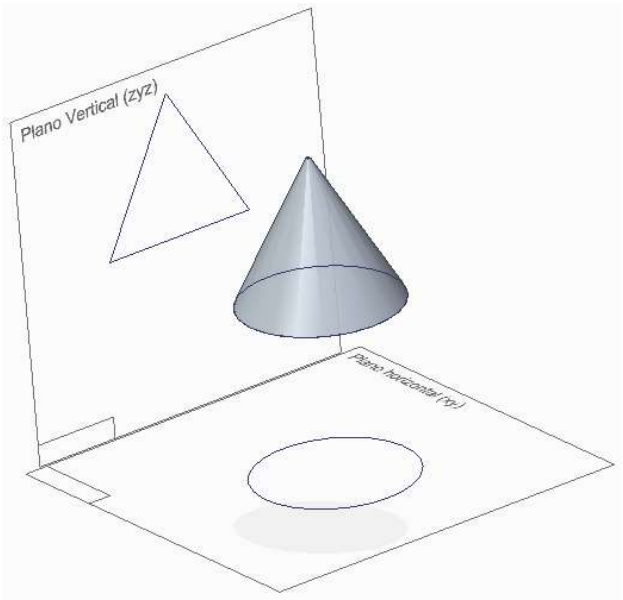

Figure 2. 3. Graphical representation of a upright cone by means of its apparent contour, in a position of base parallel to the horizontal projection plane. (Image made with Solid Edge).

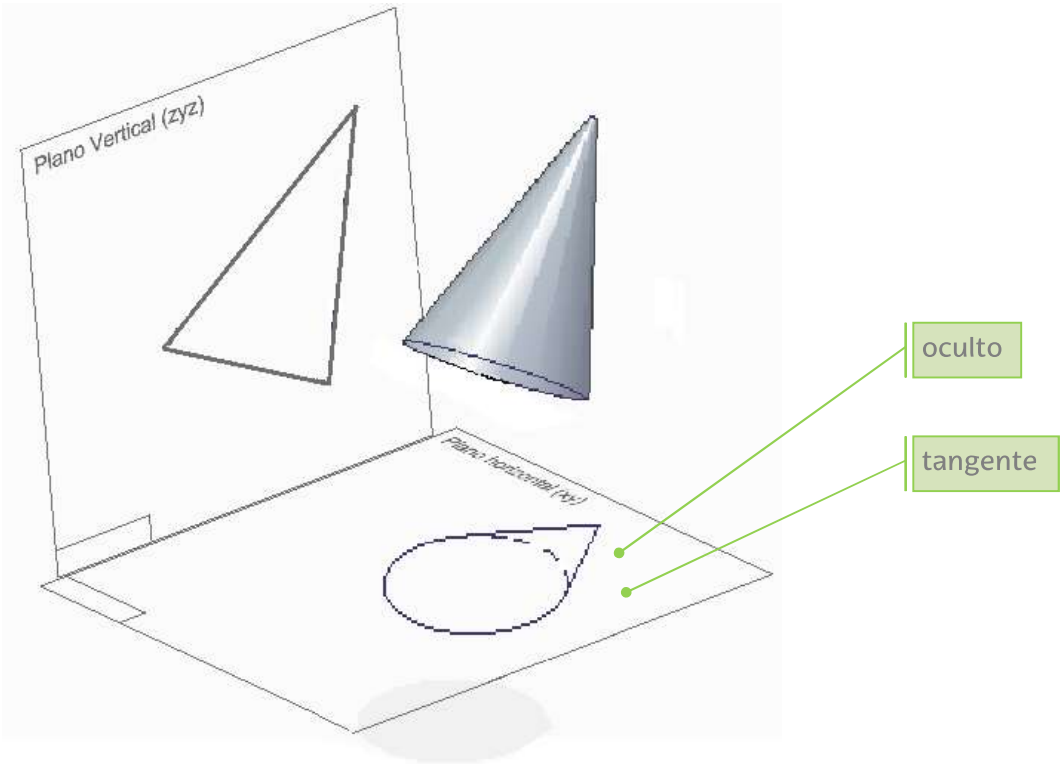

Figure 2. 4. Graphical representation of a upright cone by means of its apparent contour, in a position of base oblique to the horizontal projection plane. (Image made with Solid Edge).

2.3. Examples of surface representation

In order to summarize the different cases with different types of surfaces that we want to represent, we remind the classification established in Table 1.1. (Summary of the surfaces classification depending on the shape of the base of the axis position with respect to the base), of topic 1 Surfaces, basic concepts:

a) Polygonal or curved surfaces
b) Upright or oblique
c) Among the polygonal ones, regular or irregular
d) Among the curved ones, revolution or non revolution
e) The sphere

In addition, one more factor can be added, the fact the can be or not in a favourable position.

Surfaces are usually represented in favorable position, with their base over the horizontal projection plane. Nevertheless, if they are part of a global installation, as for example, in air conduction or raw material conduction systems, the position of the surface is conditioned by the point of view chosen to show the general installation. In those cases, the surface can appear in a non-favorable position. (in Image 2.5., the conveyor belt can be represented as a prism oblique to the horizontal projection plane).

Examples of real surfaces are shown in the following Figures 2.5. and 2.6.

Figure 2. 5. Concrete plant image (http://victoryepes.blogs.upv.es/category/cemento/).

Figure 2. 6. Surfaces are part of everyday objects (left: http://www.reciclainventa.org/2012/02/las-ventajas-del-tetra-brik.html; centre: http://www.leroymerlin.es/; right: http://spanish.tankplastic.com/

2.3.1. Examples in favourable position

Table 2. 1 summarizes the possible cases, with the image number correspondent to those images presented in the theoretical part. Other examples are included in the part of the OCW with solved exercises, and, the rest can be considered as proposed work for the student, and they are similar to those already represented. (Figures 2.7 to 2.14).

The sphere, due to its simplicity, is not represented.

POLIGONALS	**Axis**	
Base	**Upright**	**Oblique**
Regular	Pyramid (Figure 2. 3) Prism	Pyramid Prism (Figure 2. 4)
Irregular	Pyramid (Figure 2. 5) Prism	Pyramid (Figure 2. 6) Prism
CURVED	**Axis**	
Rotation	**Upright**	**Oblique**
Revolution	Cylinder Cone (Figure 2. 7)	Cylinder Cone (Figure 2. 8)
No revolution	Cylinder Cone (Figure 2. 9)	Cylinder (Figure 2. 10) Cone

Table 2. 1. Summary of the representation of the different types of basic surfaces: a) polygonal surfaces (regulars and irregulars) or curved (of revolution or not), and b) upright and obliques. At the same time, they can be in a favourable position (or not. In turn, for graphic representation, they can be in a favorable position (supported on a projection plane) or not. The sphere is a different curved surface. Those representation chosen as examples are signalled (Figures numbers).

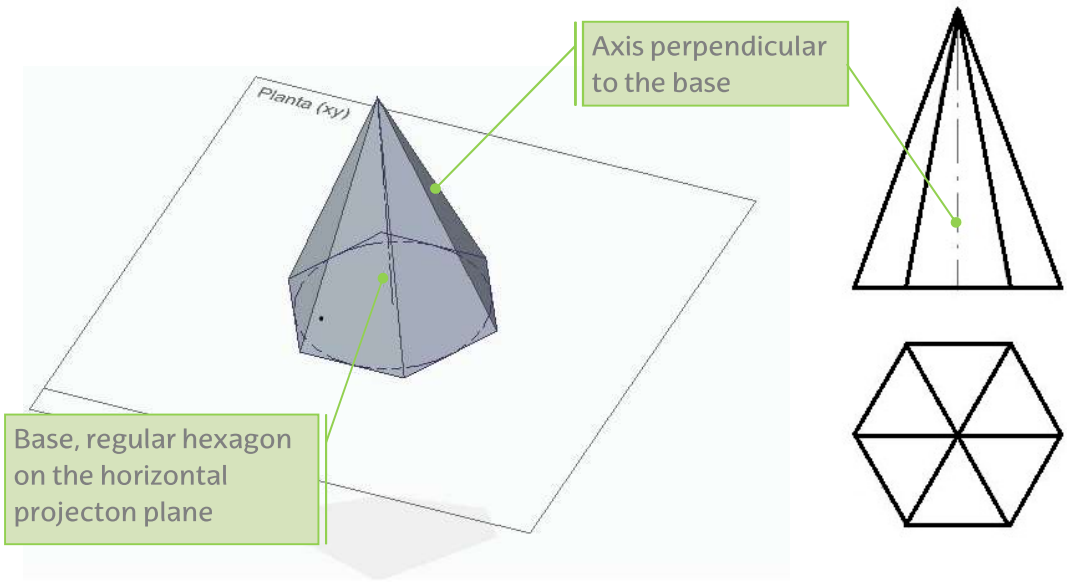

Figure 2. 7. Upright and regular pyramid, with a hexagonal base on the horizontal projection plane. Right: views. (Image made with Solid Edge).

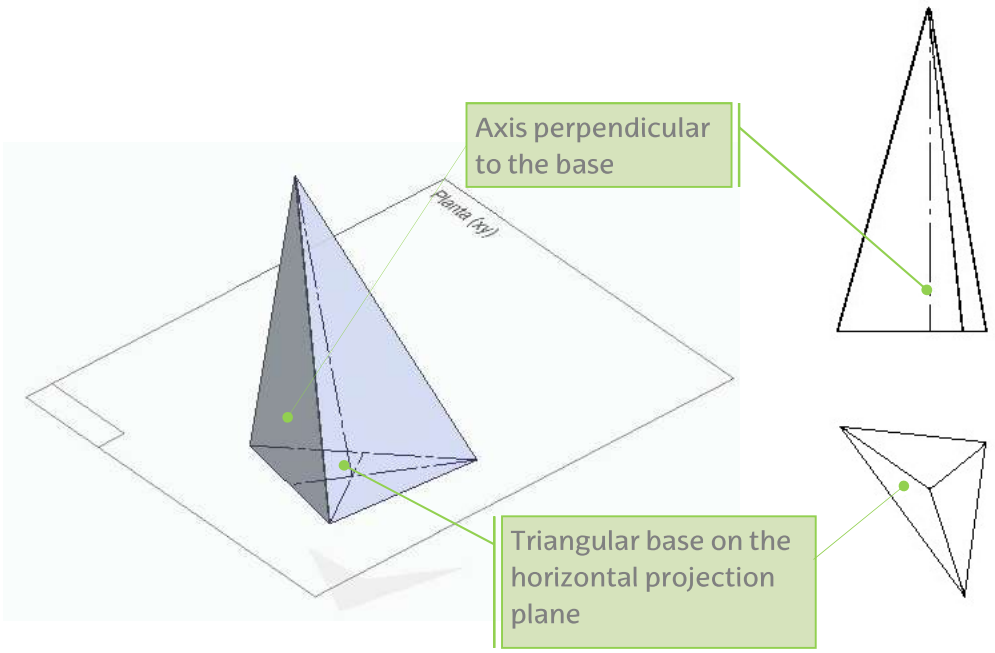

Figure 2. 8. Upright and irregular pyramid, with a triangular base on the horizontal projection plane. Right: views. (Image made with Solid Edge).

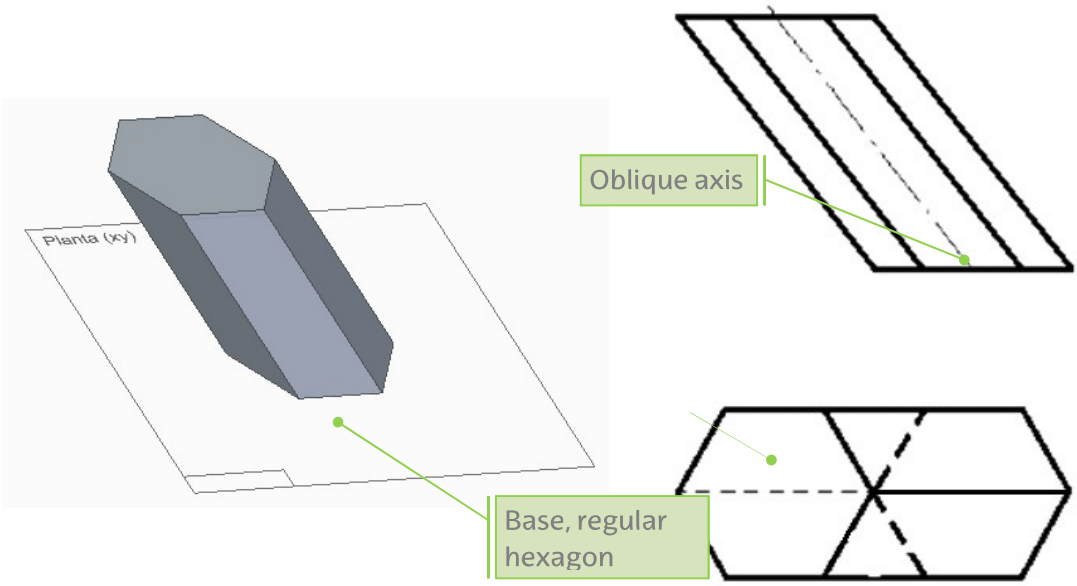

Figure 2. 9. Regular and oblique prism, with a hexagonal base on the horizontal projection plane. Right: views. (Image made with Solid Edge).

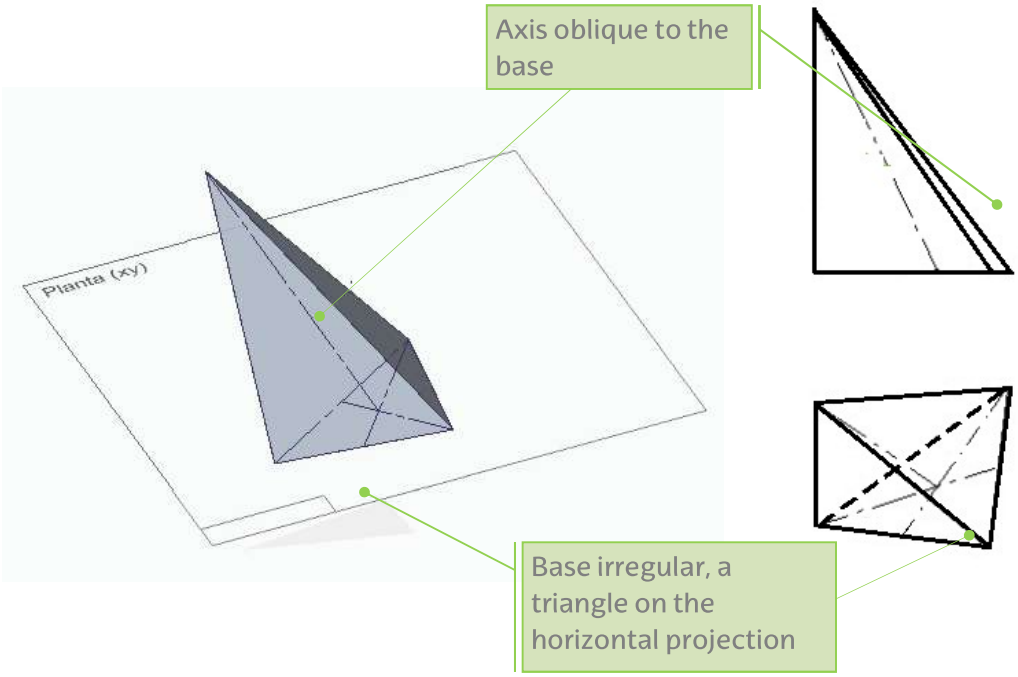

Figure 2. 10. Regular and oblique pyramid, with a triangular base on the horizontal projection plane. Right: views. (Image made with Solid Edge).

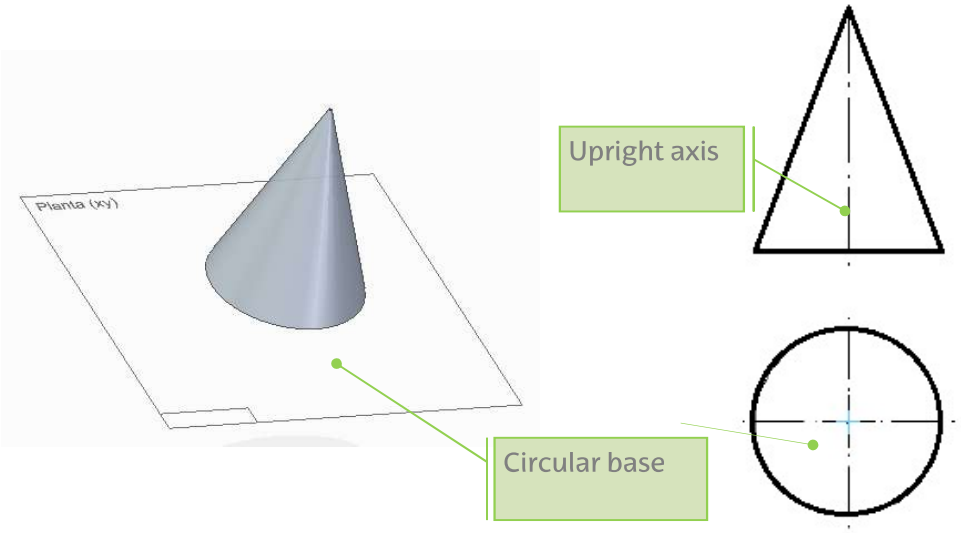

Figure 2. 11. Upright revolution cone on the horizontal projection plane. Right: views. (Image made with Solid Edge).

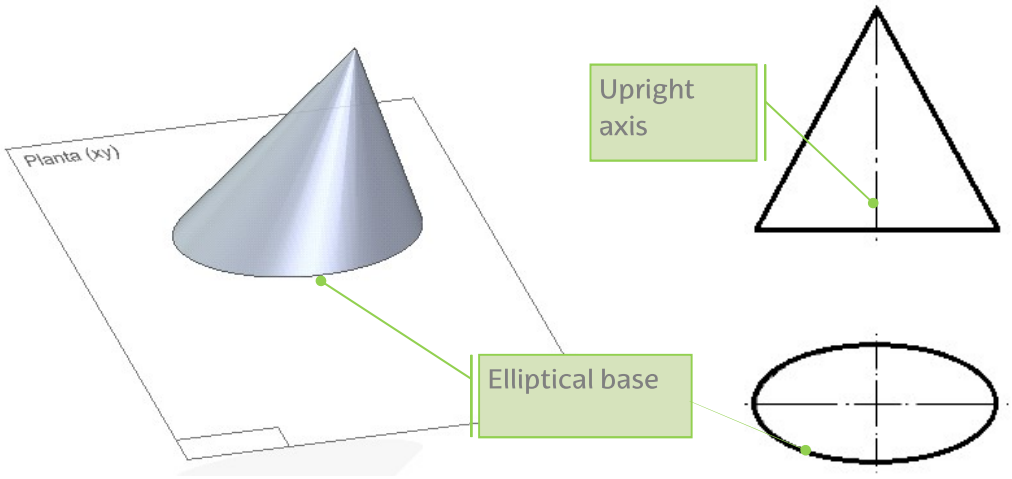

Figure 2. 12. Oblique non revolution cone on the horizontal projection plane. Right: views. (Image made with Solid Edge).

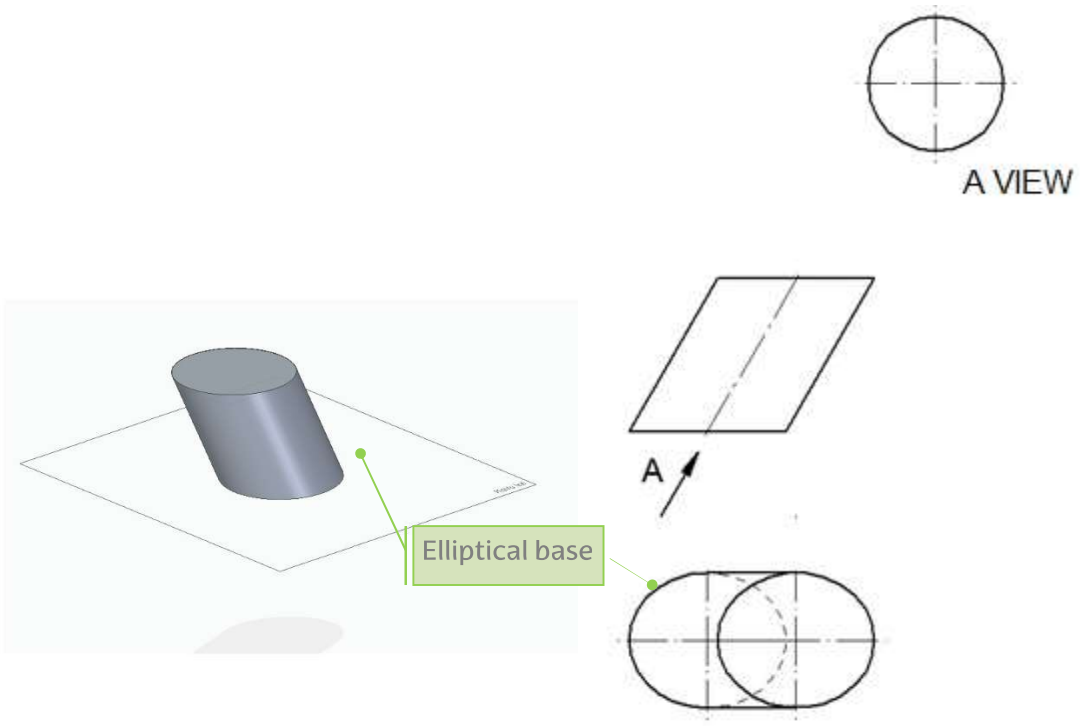

Figure 2. 13. Oblique revolution cylinder on the horizontal projection plane. Right: views. Being a revolution surface, the upright section gives a circumference. (Image made with Solid Edge).

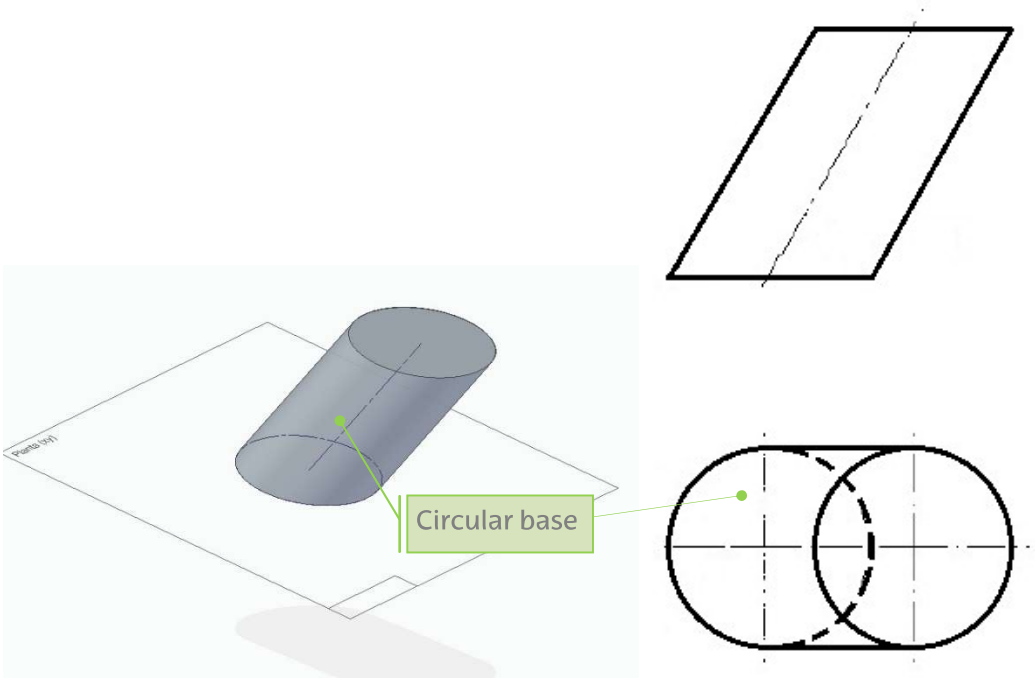

Figure 2. 14. Oblique NON revolution cylinder on the horizontal projection plane. Right: views. (Image made with Solid Edge).

2.3.2. Examples in non-favourable position

The next images present surfaces in non-favorable position (Figures 2.15 a 2.17)

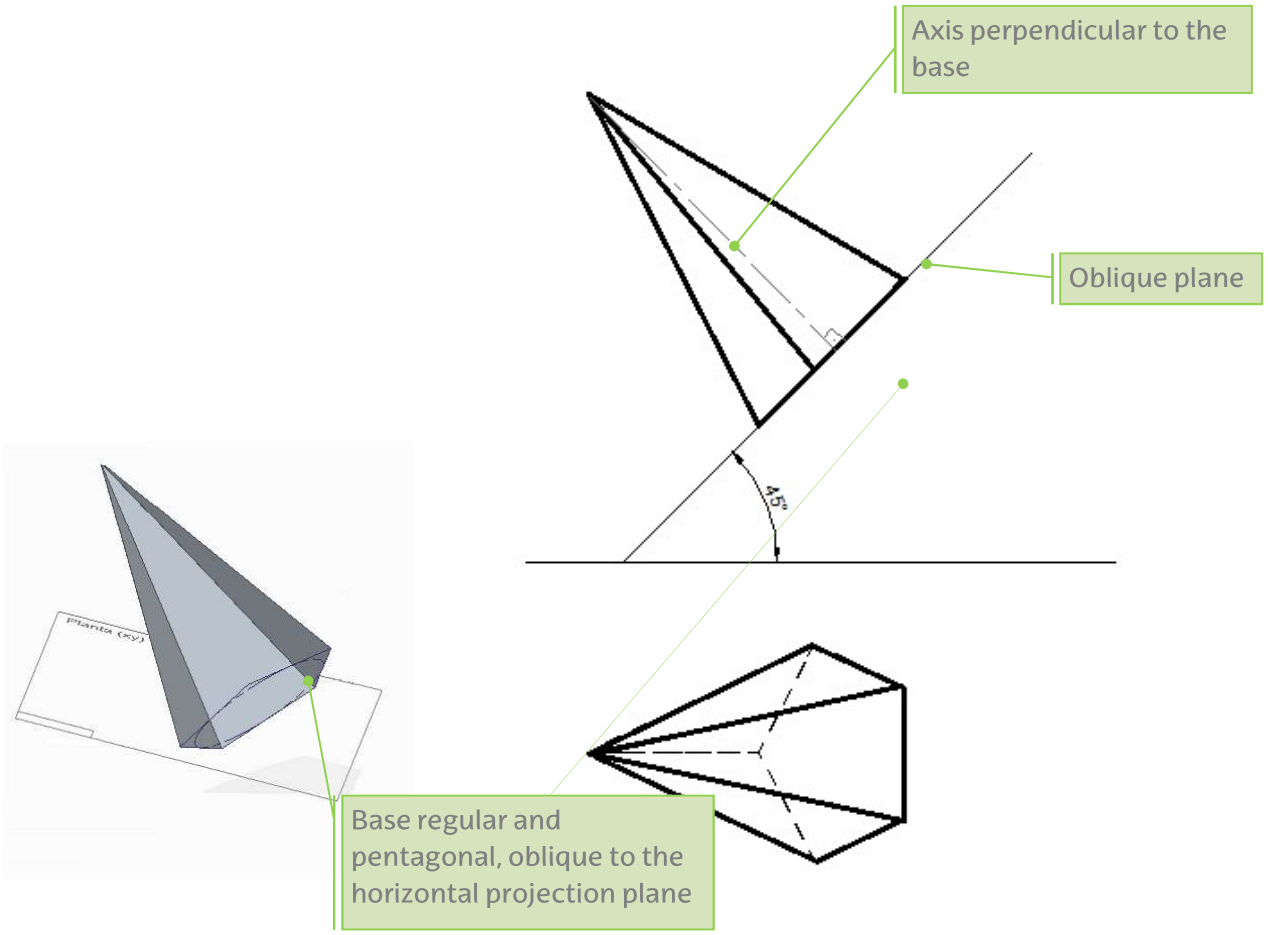

Figure 2. 15. Regular pyramid of pentagonal base on a plane that forms 45º with the horizontal projection plane. Right: views. (Image made with Solid Edge).

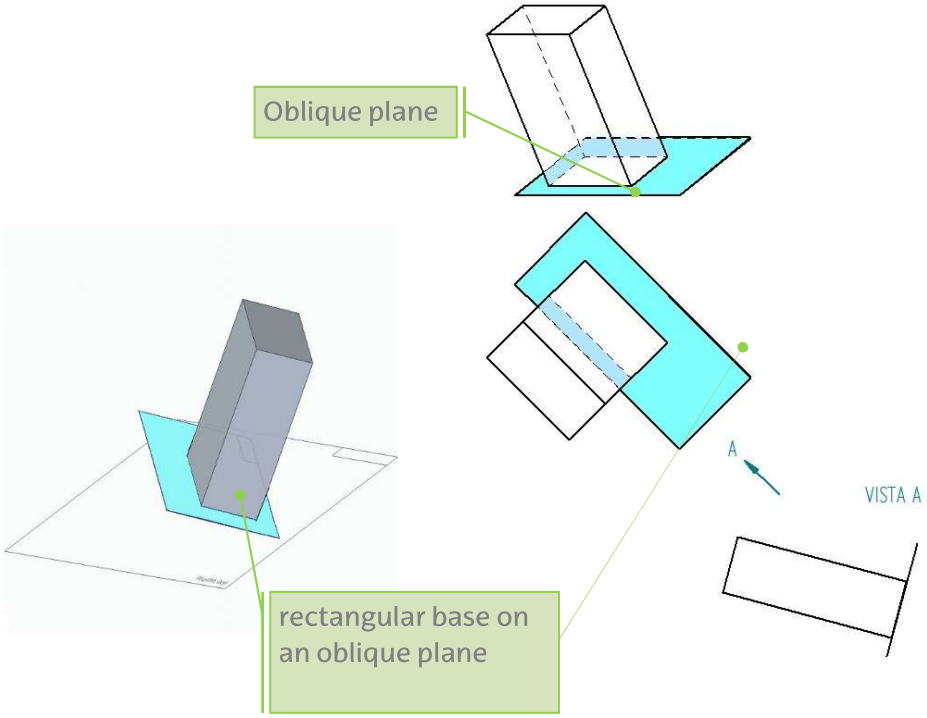

Figure 2. 16. Regular and upright prism on an oblique plane. Right: views. (Image made with Solid Edge).

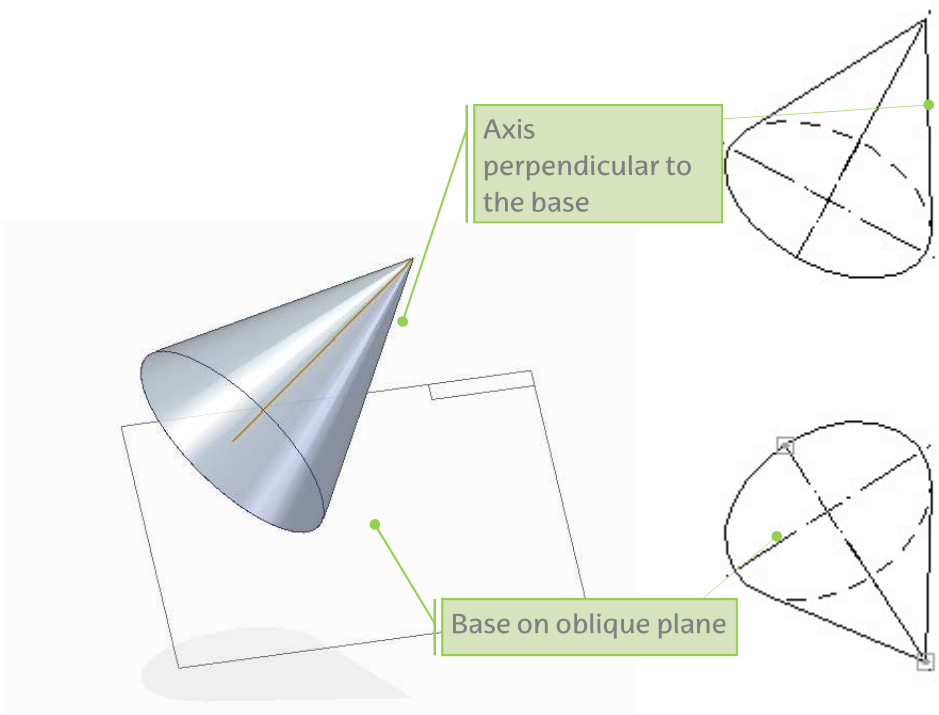

Figure 2. 17. Revolution and upright cone with a oblique base. Right: views. (Image made with Solid Edge).

2.4 Representation of objects composed of several surfaces

The representation of an object composed by several surfaces is completed by the projection of the contour lines of each of the different surfaces.

As an example, in Figure 2.18, a shower stand is represented. This object is composed by conical surfaces (interior and exterior parts) for the hand shower support, prismatic surfaces with holes. Those holes, in turn, are cylindrical surfaces that are eliminated from the drilled prismatic surfaces.

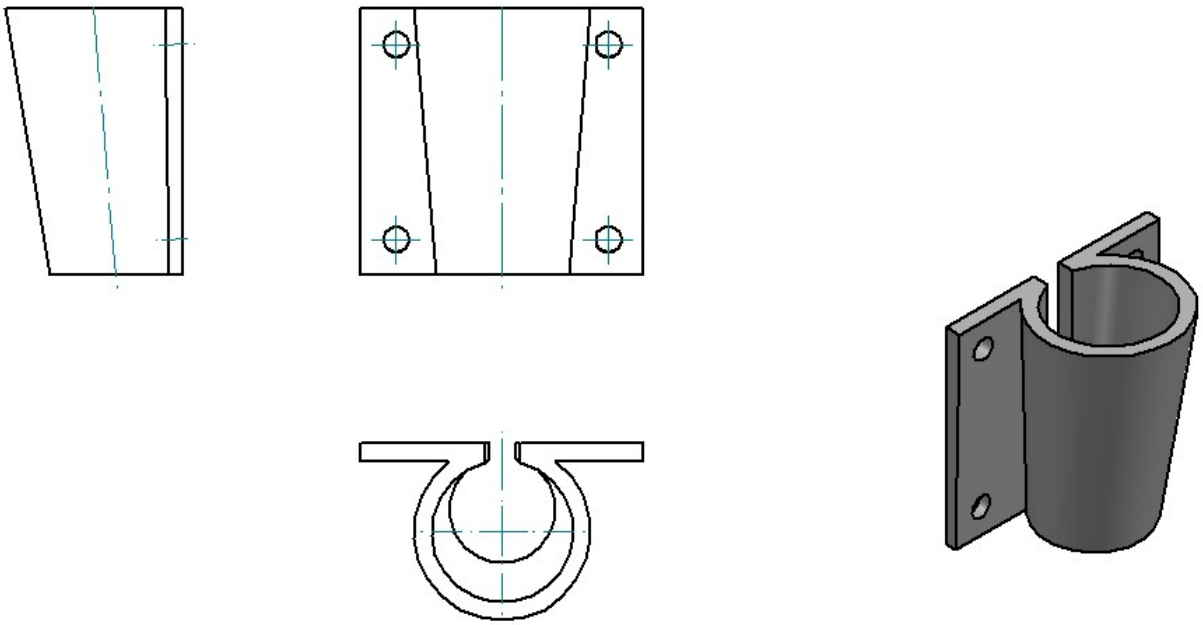

Figure 2. 18. This object is defined by means of the apparent contours of each surface that composes it. (Image made with Solid Edge).

2.5 Placing points in a surface

A point is located in a radiated Surface when it belong to one of its generatrixes. If only one of its projections is known, the other projections of the point can be found by previously drawing the generatrix that passes through the point (Figure 2.19).

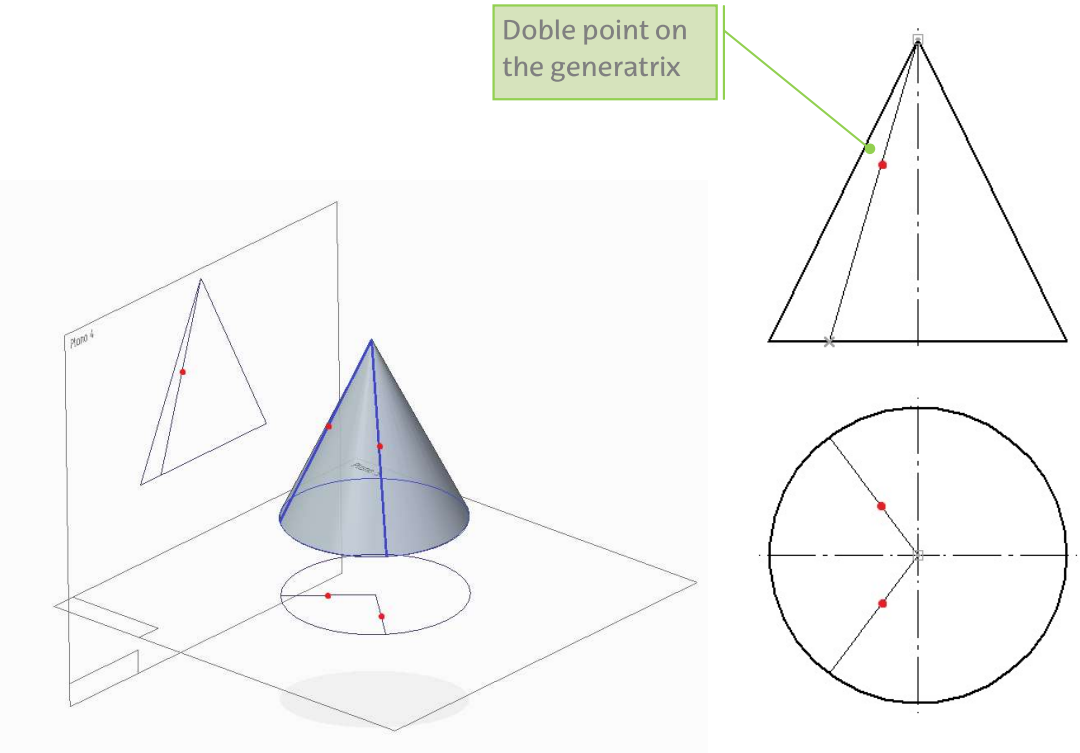

Figure 2. 19. Locating a point on the cone using the generatrices that passes through the point (Image made with Solid Edge).

Similarly, a point is located on a spherical Surface if it belongs to a parallel. When only one projection of the point is known, the other projections can be found by previously drawing the parallel that passes through the point (Figure 2.20).

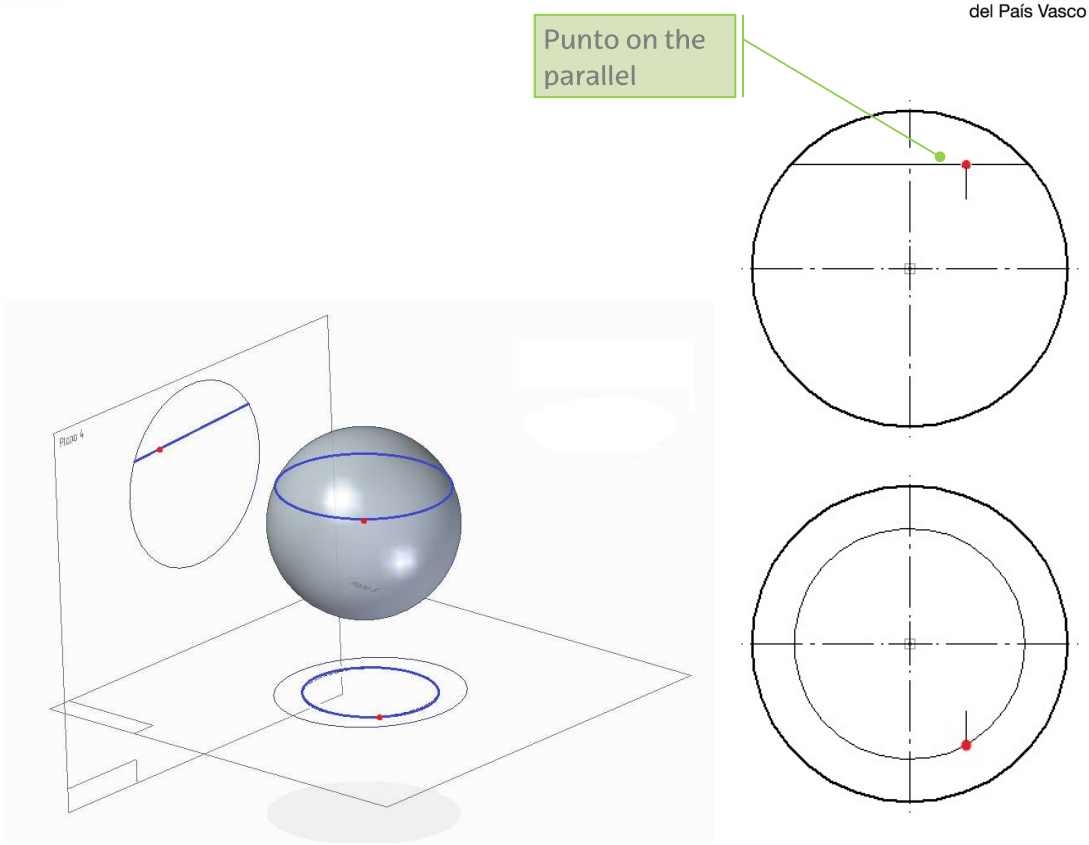

Figure 2. 20. Locating a point on the sphere using the parallels or meridians that passes through the point (Image made with Solid Edge).

Universidad del País Vasco Euskal Herriko Unibertsitatea