

Engineering Drawing

Lecture 7

Descriptive Geometry



•Gaspard Monge(1746-1818), the father of descriptive geometry, developed a graphical protocol which creates three-dimensional **virtual space** on a two-dimensional plane.

•Monge became a scientific and mathematical aide to Napoleon during his reign as general and emperor of France.





Projective Geometry

- The branch of <u>geometry</u> dealing with the properties and invariants of geometric figures under <u>projection</u>. In older literature, projective geometry is sometimes called "higher geometry," "geometry of position," or "<u>descriptive geometry</u>" (Cremona 1960, pp. v-vi).
- **Descriptive Geometry** is a graphical communication system, concerned with describing space in a mathematical way, so that the geometrical objects and their interaction can be imagined and drawn[3].



- When representing a 3-D object on the 2-D sheet of paper, the number of dimensions is reduced from 3 to 2.
- The general process of reducing the number of dimensions of a given object is called projection [6]. Mainly, there are two different ways of doing this. According to the position of observer;
- Perpective and
- Parallel Projections.

The Glass Box Method



















Signs on co-ordinates of points into different quadrants

quadranta	coordinates			
quadrants	Х	Y	Ζ	
Ι	+	+	+	
II	+	-	+	
III	+	-	-	
IV	+	+	-	



We use the 1rst angle projection (1rst quadrant), as usual in most European countries.





The two conventional planes mentioned in the preceding lecture are called planes of projection: the *horizontal* one, defined by the axes x and y; and the *frontal* one defined by the axes x and z. But pair of axes y and z defines another plane of projection which is perpendicular to both the *horizontal* and *frontal* planes. It is called *profile* plane of projection Π_3 . In Fig. 2.1 these three planes are shown in their relative positions.





Three planes of projection divide space into eight parts octants (Fig. 2.1), They are called octants or angles. Octants differ with signs on coordinates of points (Table 2.1).

octants	coordinates		ootonto	coordinates			
	Х	Y	Ζ	octants	Х	Y	Z
Ι	+	+	+	V	-	+	+
II	+	-	+	VI	-	-	+
III	+	-	-	VII	-	-	-
IV	+	+	-	VIII	-	+	-

Table 2.1 - Signs on coordinates of points into different octants







































LINE





Level line: horizontal, frontal and profile line.

- Parallel to Π1 frontal projection (on Π2) is a line, parallel to x, horizontal projection (on Π1) is a line, inclined to axis.
 profile projection (on Π3) is a line, parallel to y3.
- Parallel to $\Pi 2$ frontal projection (on $\Pi 2$) is a line, inclined to axis, horizontal projection (on $\Pi 1$) is a line, parallel to x, profile projection (on $\Pi 3$) is a line, parallel to z.
- Parallel to Π3– frontal projection (on Π2) is a line, perpendicular to x, horizontal projection (on Π1) is a line, perpendicular to x, profile projection (on Π3) is a line, inclined to axis.

Perpendicular to one of projection planes and parallel to two others is called (projection line):

horizontal-projecting, frontal-projecting and profile-projecting line











Example 7.5:

Draw the line of m, if m = [A (2,1,2) . B (4,5,3)]





True Length of line by Difference distance





if $m = [A(2,1,2) \cdot B(4,5,3)]$, Find T.L of the line m by Difference distance

Department of Surveying and Geomatics Engineering – Drawing II – Lecture 7– By Mohammed Qader

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True Length of line by Rotation method





Special positions of straight line

•Parallel to the horizontal plane





•Parallel to the vertical plane





Parallel to the side plane





•Perpendicular to the horizontal plane





Perpendicular to the Vertical plan





•Perpendicular to the Vertical plan





Any Questions ?