

UNIT- 2

Transformation

Output primitives : Output Primitives are the basic entities that are used to draw an object. These are basic structures that are used such that to give the shape of an object. The Primitives are the simple geometric functions that are used to generate various Computer Graphics required by the User. However different Graphic packages offers different output primitives like a rectangle, conic section, circle, spline curve or may be a surface. Once it is specified what picture is to be displayed, various locations are converted into integer pixel positions within the frame buffer and various functions are used to generate the picture on the two dimensional coordinate system of output display.

Point Function

A point function is the most basic Output primitive in the graphic package. A point function contains location using x and y coordinate and the user may also pass other attributes such as its intensity and color

A Line Function

A line function is used to generate a straight line between any two end points. Usually a line function is provided with the location of two pixel points called the starting point and the end point

2D Transformation : Transformation means changing some graphics into something else by applying rules. When a transformation takes place on a 2D plane, it is called 2D transformation. For a Given a 2D object, transformation is to change the object's

- Position (translation)
- Size (scaling)
- Orientation (rotation)

Translation:

A translation moves an object to a different position on the screen. You can translate a point in 2D by adding translation coordinate (t_x, t_y) to the original coordinate (X, Y) to get the new coordinate (X', Y')

Scaling:

A scaling transformation alters size of an object. In the scaling process, we either compress or expand the dimension of the object. Scaling operation can be achieved by multiplying each vertex coordinate (x, y) of the

polygon by scaling factor s_x and s_y to produce the transformed coordinates as (x', y') .

So, $x' = x * s_x$ and $y' = y * s_y$.

The scaling factor s_x, s_y scales the object in X and Y direction respectively. So, the above equation can be represented in matrix form:

$$\text{Or } P' = S . P$$

Rotation:

In rotation, we rotate the object at particular angle θ (theta) from its origin. The Rotation matrix is used for defining the rotation.

Where the rotation matrix R is

$$R = \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix}$$

Hence it is

$$\begin{bmatrix} x' & y' \end{bmatrix} = \begin{bmatrix} x & y \end{bmatrix} \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix}$$

$$P' = P.R$$

3D transformation: Methods for object modelling transformation in three dimensions are extended from two dimensional methods by including consideration for the z coordinate. Use the below link for further learning.

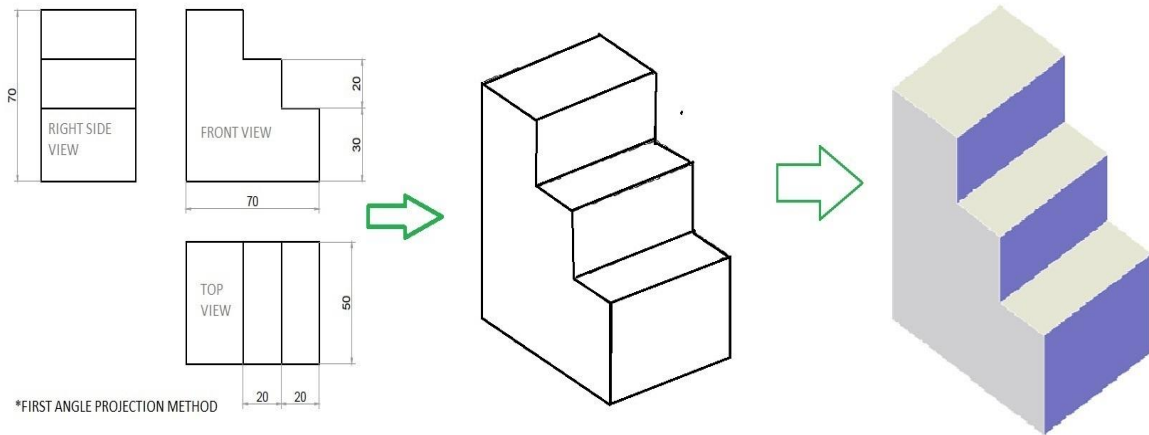
<http://ae.sharif.edu/~aerocad/3D%20Transformation.pdf>

Projections: orthographic & Isometric

I have summed up these two methods of drawing which are as follows

1. Orthographic projection shows only one side of an object on a principal plane while the other sides will be shown on other principal planes.
2. Orthographic Projection shows you the true size of the object, if you are drawing on 1:1 scale but Isometric Projection do not.
3. Orthographic Projections are drawn at 90 degrees but Isometric projections are drawn at 30 degrees.
4. You need to draw at least the three essential views if you are drawing in Orthographic Projection but for Isometric only one figure is drawn.
5. Orthographic Projection is used for making the projects but Isometric Projection is used to have better understanding of the object.

Isometric projection of an object is how the object looks to naked eye when seen from a distance. When seen from a distance the object doesn't look as it actually is, it looks smaller and so is the isometric projection of the object.



Orthographic Views

Multiple 2D Views

Isometric View

One 3D View

Realistic View