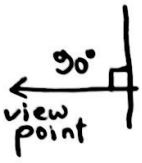
Angle

Orthographic projection

(viewpoint is perperdicular on the object)



(Top or front view)

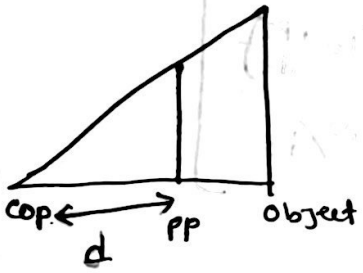
one surface

Oblique projection

Distance

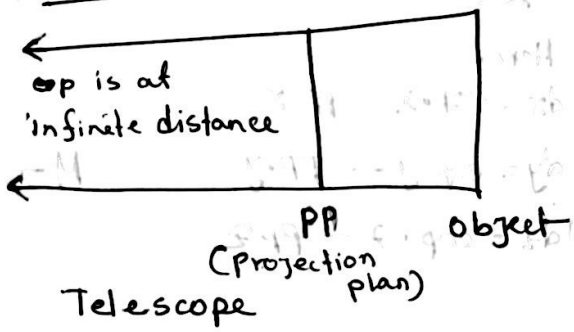
Perspective projection

1) Peri. (dis limited)



Parallel projection

(d is infinite)



Projection Matrix in orthographic projection:

(x, y, z) Project on xy plane (where $z = -13$) $\rightarrow (x, y, -13)$

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 10 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

zx plane ($y = 10$) $\rightarrow (x, 10, z)$ [যে plane এ থাকবে সেটার unchanged]

$$\ast \begin{bmatrix} x' \\ y' \\ z' \\ 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & -13 \\ 0 & 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix} = \begin{bmatrix} x \\ y \\ -13 \\ 1 \end{bmatrix}.$$

General Projection Matrix

$p' = mp$

xy plane will be given in the ques

Here,

$dx = COP.x - PP.x$

$dy = cop.y - PP.y$

$dz = cop.z - PPz$

$$M = \begin{bmatrix} 1 & 0 & \frac{-dx}{dz} & dx/dz * PPz \\ 0 & 1 & -dy/dz & dy/dz * PPz \\ 0 & 0 & -PPz/dz & PPz\left(1 + \frac{PPz}{dz}\right) \\ 0 & 0 & -1/dz & 1 + PPz/dz \end{bmatrix}.$$

cop = centre of projection.

PP = plane projection.

* Given COP(50,40,100) and PP(0,0,-200) find out the projected point for the given input (30,50,-250)?

Solution

$dx = 50 - 0 = 50$

$dy = 40 - 0 = 40$

$dz = 100 - (-200) = 300$

$$\begin{bmatrix} x' \\ y' \\ z' \\ 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & -50/300 \\ 0 & 1 & -40/300 \\ 0 & 0 & \frac{-(-200)}{300} \\ 0 & 0 & -1/300 \end{bmatrix} \begin{bmatrix} 30 \\ 50 \\ -250 \\ 1 \end{bmatrix} = \begin{bmatrix} 115/3 \\ 170/3 \\ -700/3 \\ 1.167 \simeq 1 \end{bmatrix} = \begin{bmatrix} 32.85 \\ 48.5 \\ -200 \\ 1 \end{bmatrix}$$

Final Ans

↳ value might not be 1.

So normalize it by dividing each data by 1.167 or what the value is.

Important for Exam

xy plane

Case 1 Find out the matrix where cop is at origin and pp is not at d distance from cop.

COP(0,0,0)

PP(0,0,d)

$dx = 0 - 0 = 0$

$dy = 0 - 0 = 0$

$dz = 0 - d = -d$

$$M = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 1/d & 0 \end{bmatrix}$$

input points

$$\begin{bmatrix} \quad \\ \quad \\ \quad \\ \quad \end{bmatrix} = \begin{bmatrix} x' \\ y' \\ z' \\ 1 \end{bmatrix}$$

Important

Case 2 Find out the matrix where PP is at origin and COP is at d distance from PP?

COP (0,0,d)

PP, (0,0,0)

$dx = 0 - 0 = 0$

$dy = 0 - 0 = 0$

$dz = d - 0 = d$

$$M = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & -1/d & 1 \end{bmatrix}$$