Lecture - 28
MDU

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Projection -

The world coordinate description of an object in a scene is converted to viewing coordinate.
The 3D view is projected on a 2D view plane.

Types of projection -
a) Parallel projection
b) Perspective

planar geometric projection
- parallel
  - multiview orthographic
  - axonometric
    - isometric
    - dimetric
    - trimetric
  - oblique
- perspective
  - 1 point
  - 2 point
  - 3 point

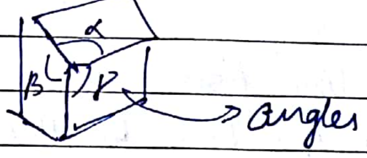
Parallel projection
coordinate posi^n are transformed to the view plane along parallel lines.
Relative positions are maintained

Perspective projection
object positions are transformed to the view plane along lines that converge to a point called projection reference point.

Orthographic projection
- Elevation - Front side, rear ~~side~~ orthographic proj^n
- Plan view : top orthographic projection of an object.

Axonometric orthographic projection

- Can display more than one face at a time.
- Isometric projection: by aligning projection plane such that it intersects each co-ordinate axis in which -



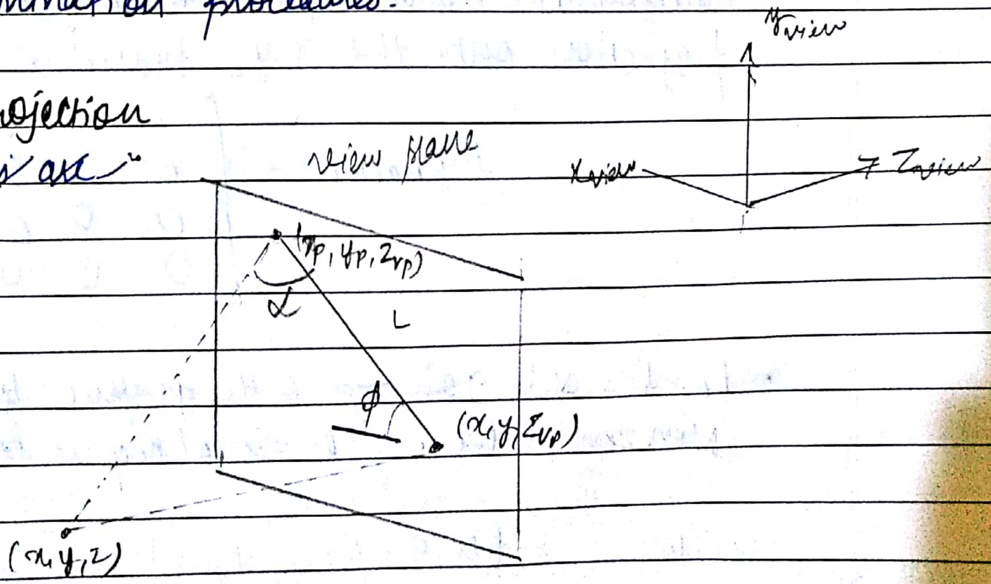
- Isometric – All angles are equal
- Dimetric – Two angles are equal
- Trimetric – None of the angles are equal.

Transformation equation of orthographic parallel projection.

- View plane is placed at position z_{vp} along the the z_v axis.
- Any point (x, y, z) in viewing coordinate is transformed to projection co-ordinate as $x_p = x$; $y_p = y$.
- Original z coordinate value is preserved for depth information needed in depth cueing and visible surface determination procedures.

Oblique projection

Projectors are :-



Transformation equations of oblique parallel projection

- Oblique projection vector is specified by two angles: α and θ.
- Point (x, y, z) is projected at a position (x_p, y_p) on view plane.
- Orthographic projection coordinates on the plane are (x, y).
- The oblique projection line from (x, y, z) to (x_p, y_p) makes an angle with the line on the projection plane that joins (x_p, y_p) and (x, y)
- The line of length L, is at angle ϕ with the horizontal direction on the projection plane.
- Projection ~~coord~~ coordinates are defined in terms of x, y, L, ϕ as

$$-x_p = x + L\cos\phi \quad \text{and} \quad y_p = y + L\sin\phi$$

$$-\tan\alpha = z/L \quad ; L = z/\tan\alpha \ ; \ L = zL_1$$

$$L_1 = \frac{1}{\tan\alpha} ; \text{if } z=1, L_1 = L$$

$$-x_p = x + z(L_1\cos\phi) \quad \text{and} \quad y_p = y + z(L_1\sin\phi)$$

- Transformation matrix for producing any parallel projection onto the x, y plane is

$$M_{parallel} = \begin{bmatrix} 1 & 0 & L_1\cos\phi & 0 \\ 0 & 1 & L_1\sin\phi & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

- $L_1 = 1$, $\alpha = 90°$ $\rightarrow$ orthographic projection
  Non zero value of $L_1 \Rightarrow$ oblique projection

Cavalier - $\tan\alpha = 1$ $\quad L_1 = 1$

Cabinet $\quad \tan\alpha = 2 \quad L_1 = 1/2$