8.5 PROJECTIONS

- All real world object are three-dimensional, but when it comes to any display medium or device, they are two dimensional. Therefore, there is a need to display 3D objects in the 2D form. This is possible with the help of projections.

- Projection is a process of representing a three dimensional object or scene to a two dimensional medium. In general, a projection is a transformation from an n dimensional space to an m dimensional space where $m < n$.

- There are three basic terms related to projection :

  1. **Centre of Projection.** The point from where projection is taken. It can either be light source or eye position.

  2. **Projection Plane.** It is a plane or surface onto which the projection of the object in formed. It is also known as **view plane**.

3. **Projectors.** Lines emerging from centre of projection are called projectors. These lines hit the projection plane after passing through a point in the object to be projected.

- Thus, projection can be defined as : mapping of point P(x, y, z) onto its image P′ (x′, y′, z′) in the projection plane or view plane. This mapping is determined by a projection line called projector that passes through P and intersects the view plane at P′ (see figure 8.11)
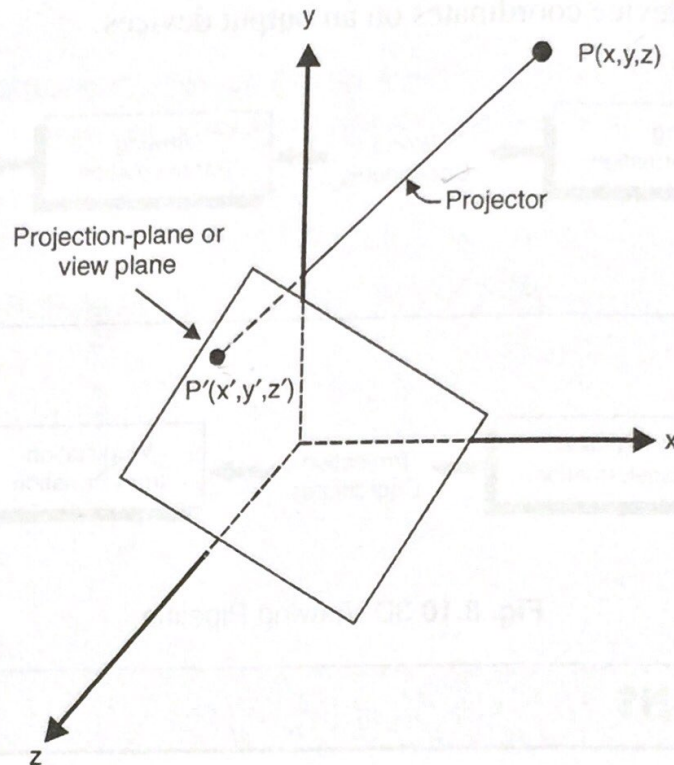
Fig. 8.11 Projection of 3D point on 2D surface

- The concept of projections is used by architects, engineers, artists, painters, designers, drafters to represent 3D scene or object on a two dimensional medium.
- There are two basic types of projection : perspective projection and parallel projection.

  1. **Perspective Projection.** For a perspective projection, object positions are transformed to the view plane along lines that converge to a point called the **centre of projection** or **projection reference point** (see figure 8.12). The projected view of an object is determined by calculating the intersection of the projection lines with the view plane.

Thus, in perspective projection centre of projection (CP) is at finite distance from view plane.
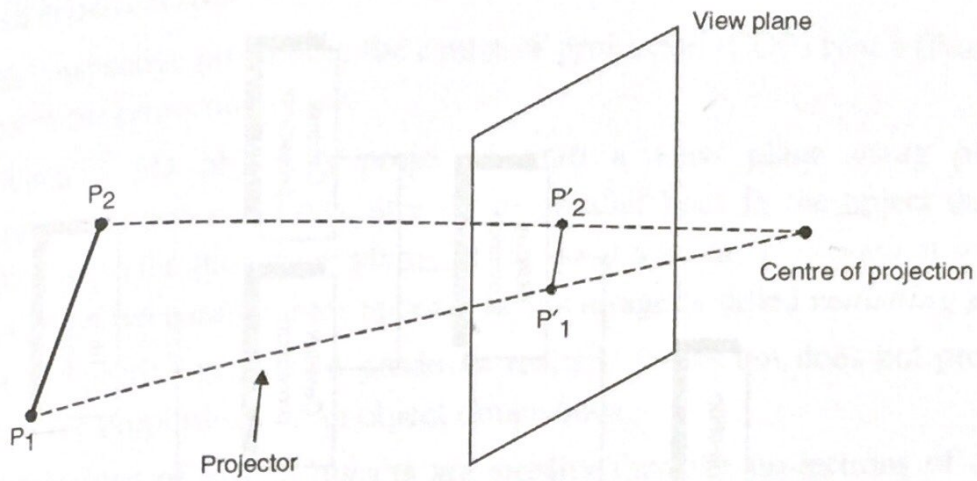
View plane

P₂

P'₂

Centre of projection

P'₁

P₁

Projector

Fig. 8.12 Perspective Projection

2. **Parallel Projection.** In parallel projection, coordinate positions are transformed to the view plane along parallel lines (see figure 8.13)

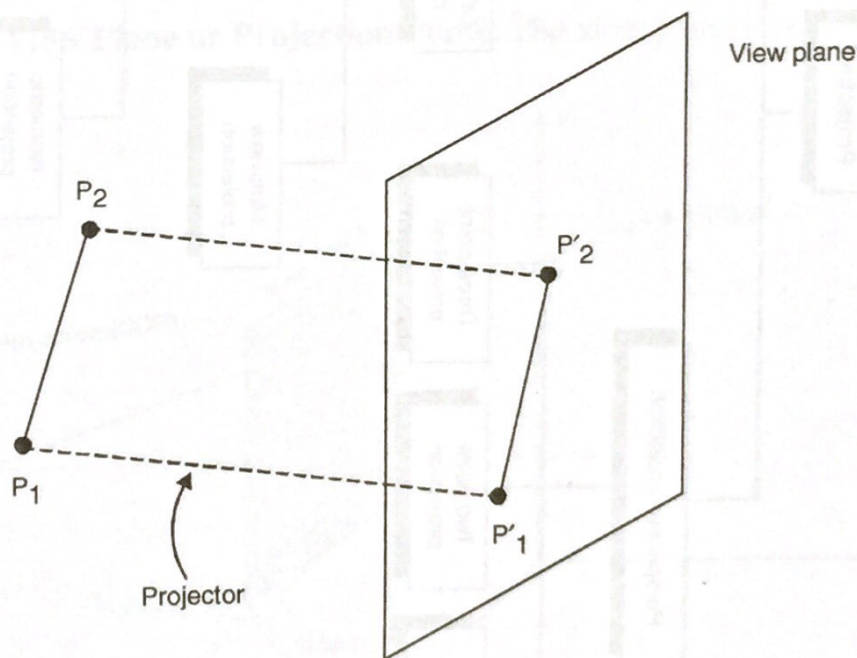View plane

P₂

P'₂

P₁

P'₁

Projector

Fig. 8.13 Parallel Projection

Thus, in parallel projection centre of projection is at infinity and all the projectors are parallel.