

Representation of a Point in Space

A point P in space: 3 coordinate relative to a reference frame

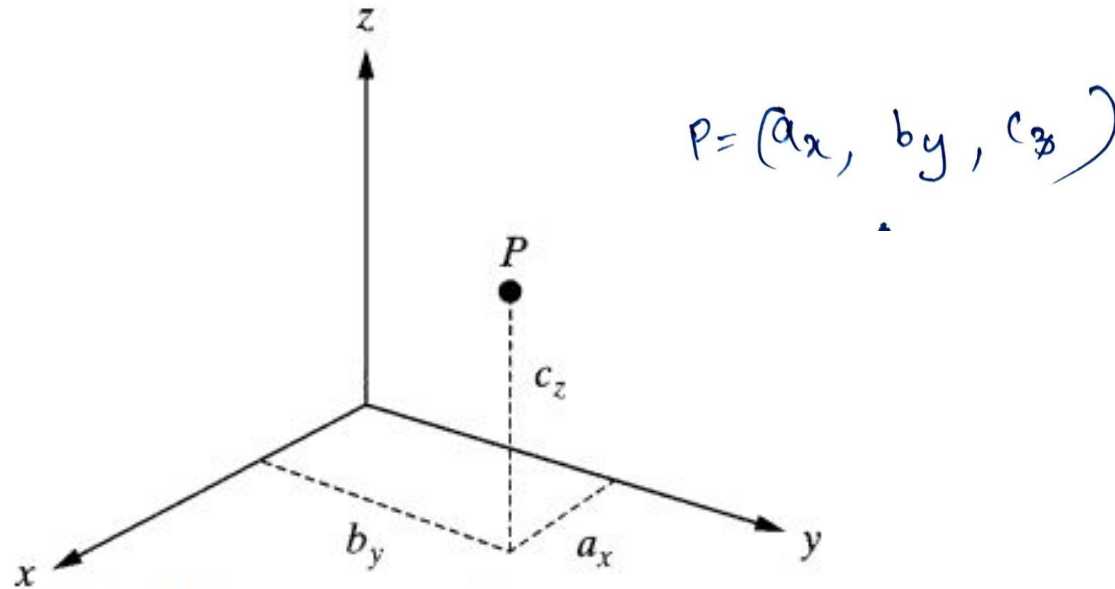
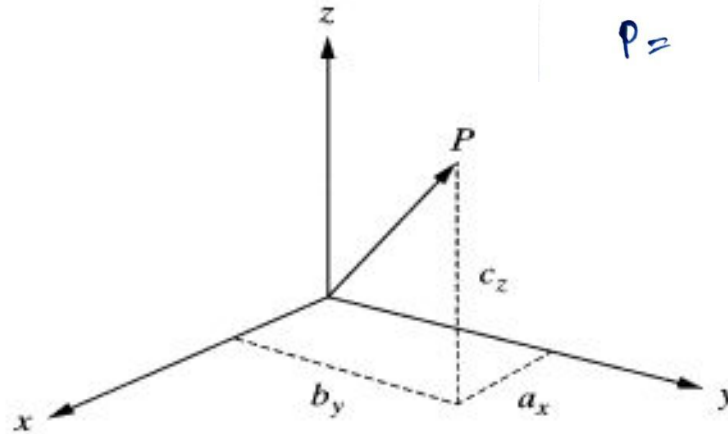


Fig 2.5 Representation of a point in space

Representation of a Vector in Space

A Vector P in space: 3 coordinates of its tail and of its head



$$P = a\hat{i} + b\hat{j} + c\hat{k}$$

$$P = \begin{bmatrix} a \\ b \\ c \end{bmatrix}$$

Representation of a Frame at the Origin of a Fixed-Reference Frame

Each Unit Vector is mutually perpendicular: normal, orientation, approach vector

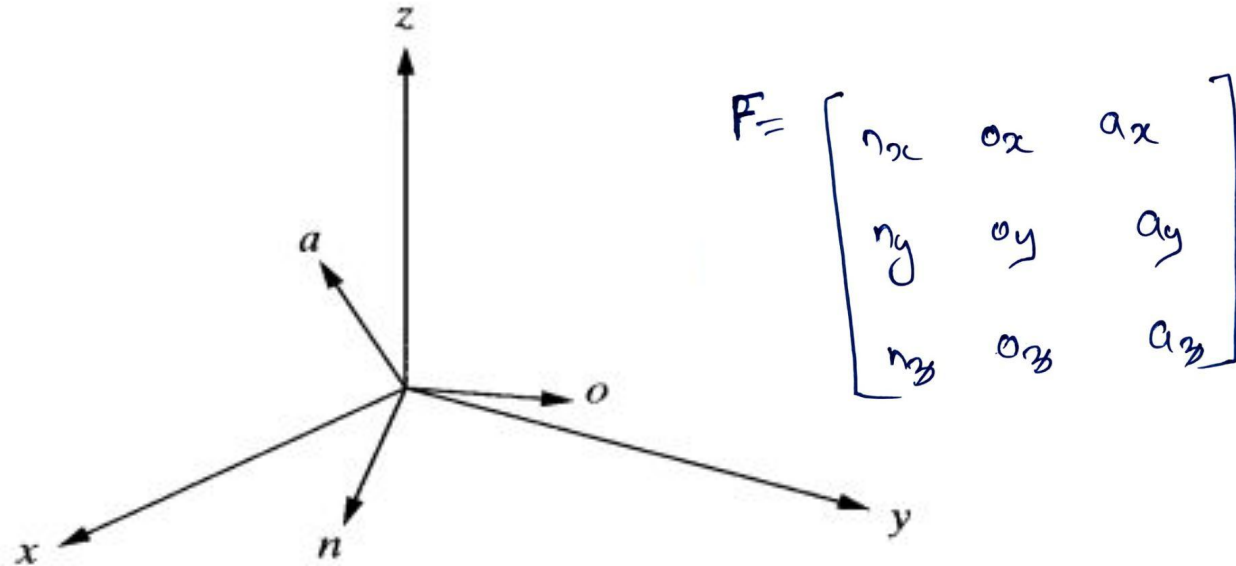
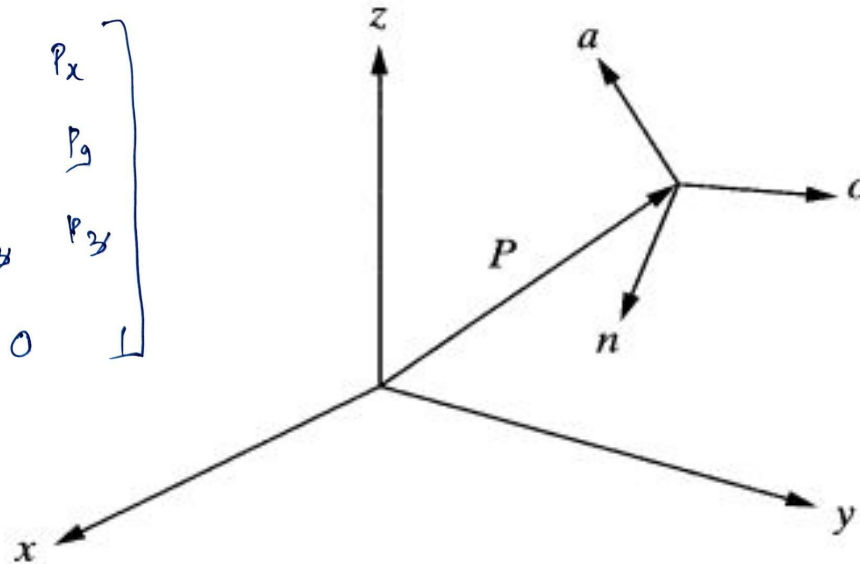


Fig. 2.7 Representation of a frame at the origin of the reference frame

Representation of a Frame in a Fixed Reference Frame

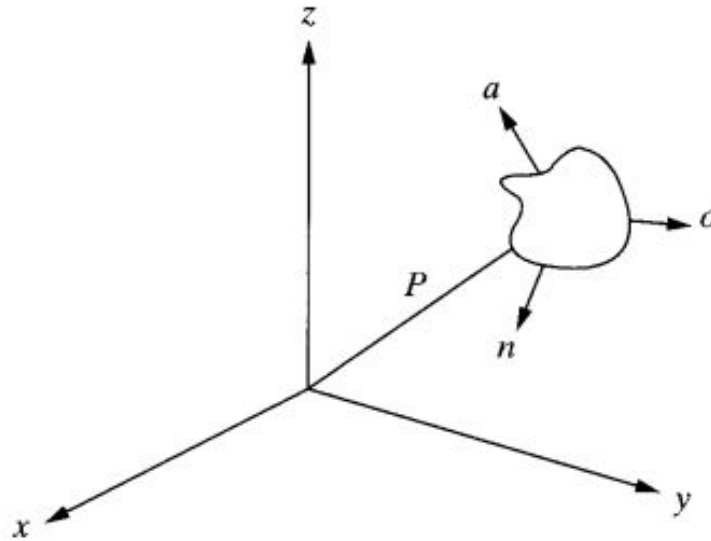
Each Unit Vector is mutually perpendicular: normal, orientation, approach vector

$$F = \begin{bmatrix} n_x & o_x & a_x & p_x \\ n_y & o_y & a_y & p_y \\ n_z & o_z & a_z & p_z \\ 0 & 0 & 0 & 1 \end{bmatrix}$$



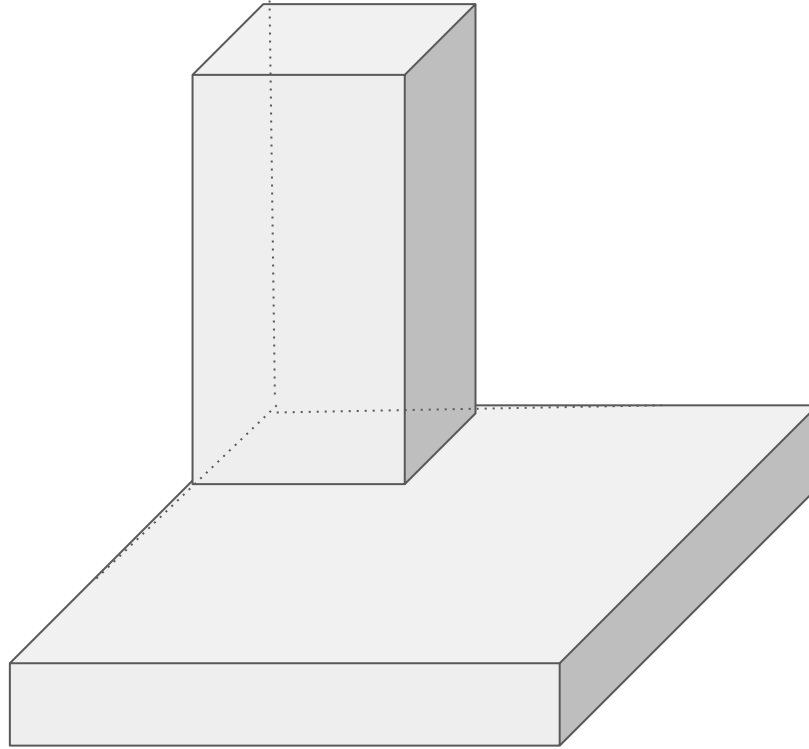
Representation of a Rigid Body

An object can be represented in space by attaching a frame to it and representing the frame in space.



$$F = \begin{bmatrix} n_x & o_x & a_x & p_x \\ n_y & o_y & a_y & p_y \\ n_z & o_z & a_z & p_z \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Single Axis Robot



Single Axis Robot

