AE - 415

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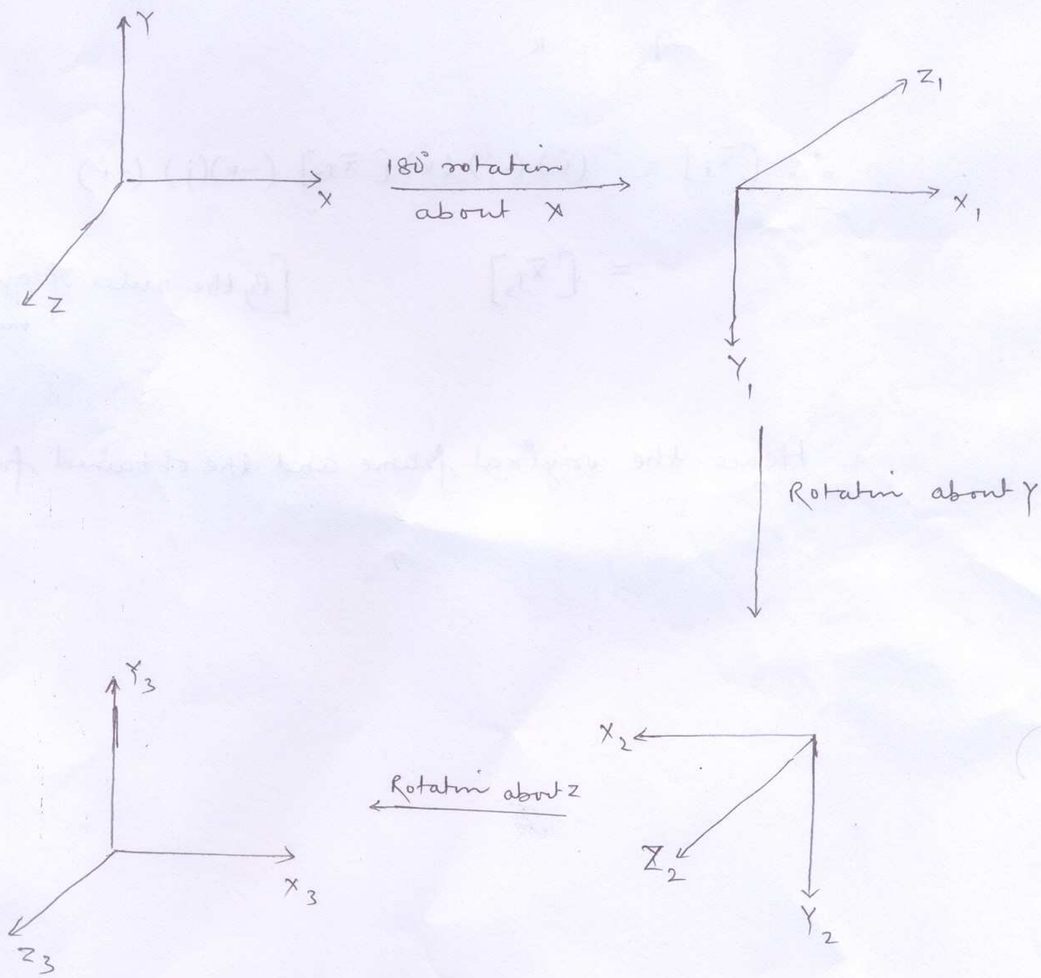
(54) suppose $(\bar{x})$ is a vector in frame I, which is rotated successively 180° about three perpendicular axes

$$I \longrightarrow I_1 \longrightarrow I_2 \longrightarrow I_3$$



As I_1 is obtained from I by rotation of 180°

$$[\bar{x}_I] = q_1 [\bar{x}_{I_1}] \bar{q}_1$$

Also

$$[\bar{x}_{I_1}] = q_2 [\bar{x}_{I_2}] \bar{q}_2$$

$$[\bar{x}_{I_3}] = q_3 [\bar{x}_{I_3}] \bar{q}_3$$

$$\therefore \quad [\bar{x}_I] = q_1 q_2 q_3 [\bar{x}_{I_3}] \bar{q}_3 \bar{q}_2 \bar{q}_1$$

Quaternions for the first rotation φ

$$q_1 = \cos\frac{180^\circ}{2} + \sin\frac{180}{2}\,(i + 0 + 0)$$

$$= i$$

similarly

$$q_2 = -j$$

$$q_3 = K$$

$$\therefore\ [\bar{X}_I] = (i)(-j)(k)[\bar{X}_{I_3}](-k)(j)(-i)$$

$$= [\bar{X}_{I_3}]$$

[By the rules of quaternion multiplication]

Hence the original frame and the obtained frame are same.