0901AI201013

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Assignment - 1

q. 1

Soln ⇒ (i) Rotate an angle of 90° around $\hat{Z}_0$.

$$T_1 = Rot(\hat{Z}_0, 90^\circ) = \begin{bmatrix} \cos 90^\circ & -\sin 90^\circ & 0 & 0 \\ \sin 90^\circ & \cos 90^\circ & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

(ii) Rotate an angle 45° around $\hat{y}_0$.

$$T_2 = Rot(\hat{y}_0, 45^\circ) = \begin{bmatrix} \cos 45^\circ & 0 & \sin 45^\circ & 0 \\ 0 & 1 & 0 & 0 \\ -\sin 45^\circ & 0 & \cos 45^\circ & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

(iii) Rotate an angle of 30° around $\hat{Z}_0$

$$T_3 = Rot(\hat{Z}_e, 30^\circ) = \begin{bmatrix} \cos 30^\circ & -\sin 30^\circ & 0 & 0 \\ \sin 30^\circ & \cos 30^\circ & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$OT_e = T_1 T_2 T_3$$

$$\begin{bmatrix} 1/\sqrt{2} & 0 & 1/\sqrt{2} & 0 \\ 0 & 1 & 0 & 0 \\ -1/\sqrt{2} & 0 & 1/\sqrt{2} & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 0 & -1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} -\sqrt{3}/2 & 1/2 & 0 & 0 \\ 1/2 & \sqrt{3}/2 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} -1/2\sqrt{2} & -\sqrt{3}/2\sqrt{2} & 1/\sqrt{2} & 0 \\ \sqrt{3}/2 & -1/2 & 0 & 0 \\ 1/2\sqrt{2} & \sqrt{3}/2\sqrt{2} & 1/\sqrt{2} & 0 \\ & & & 1 \end{bmatrix}$$

Q.2

Sol^n ⇒ (i) Rotate an angle 90° around $\hat{x}_0$.

$$T_1 = Rot(\hat{x}_0, 90^\circ) = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos 90^\circ & -\sin 90^\circ & 0 \\ 0 & \sin 90^\circ & \cos 90^\circ & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

(ii) Move 5 units along $\hat{x}_0$.

$$T_2 = \begin{bmatrix} 1 & 0 & 0 & 5 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$

(iii) Rotate an angle of 45° around $\hat{y}_0$.

$$T_3 = \begin{bmatrix} \cos 45^\circ & 0 & \sin 45^\circ & 0 \\ 0 & 1 & 0 & 0 \\ -\sin 45^\circ & 0 & \cos 45^\circ & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$T_1 \cdot T_2 \cdot T_3 = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 5 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1/\sqrt{2} & 0 & 1/\sqrt{2} & 0 \\ 0 & 1 & 0 & 0 \\ -1/\sqrt{2} & 0 & 1/\sqrt{2} & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 1/\sqrt{2} & 0 & 1/\sqrt{2} & 5 \\ 1/\sqrt{2} & 0 & -1/\sqrt{2} & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

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Assignment (1)

Q.2
⇒

Coordinate of the p vector expressed on the {0} system.

$$P = (1, 1, 1, 1)^T$$

$$\Rightarrow \begin{bmatrix} 1/\sqrt{2} & 0 & 1/\sqrt{2} & 5 \\ 1/\sqrt{2} & 0 & -1/\sqrt{2} & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix} = \begin{bmatrix} \sqrt{2}+5 \\ 0 \\ 1 \\ 1 \end{bmatrix}$$

⇒ So $(\sqrt{2}+5, 0, 1, 1)$ are the coordinate of the p vector.