

Tarea 3.

Matrices de Rotación.

Alumna:

Hernández Castillo Ana Yuritzi.

Grado y grupo:

8°A

Materia:

Cinemática de Robots.

Carrera:

Ingeniería Mecatrónica.

1.- $\rightarrow x=90^\circ \quad \rightarrow y=30^\circ \quad \rightarrow z=70^\circ$

$$R(x, \alpha) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos \alpha & -\sin \alpha \\ 0 & \sin \alpha & \cos \alpha \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos 90^\circ & -\sin 90^\circ \\ 0 & \sin 90^\circ & \cos 90^\circ \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & -1 \\ 0 & 1 & 0 \end{bmatrix}$$

$$R(y, \beta) = \begin{bmatrix} \cos \beta & 0 & \sin \beta \\ 0 & 1 & 0 \\ -\sin \beta & 0 & \cos \beta \end{bmatrix} = \begin{bmatrix} \cos 30^\circ & 0 & \sin 30^\circ \\ 0 & 1 & 0 \\ -\sin 30^\circ & 0 & \cos 30^\circ \end{bmatrix} = \begin{bmatrix} 0.8660 & 0 & 0.5 \\ 0 & 1 & 0 \\ -0.5 & 0 & 0.8660 \end{bmatrix}$$

$$R(z, \theta) = \begin{bmatrix} \cos \theta & -\sin \theta & 0 \\ \sin \theta & \cos \theta & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} \cos 70^\circ & -\sin 70^\circ & 0 \\ \sin 70^\circ & \cos 70^\circ & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 0.3420 & -0.9396 & 0 \\ 0.9396 & 0.3420 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$T = Rot_z(\theta) Rot_y(\beta) Rot_x(\alpha) =$$

$$\begin{bmatrix} 0.3420 & -0.9396 & 0 \\ 0.9396 & 0.3420 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 0.8660 & 0 & 0.5 \\ 0 & 1 & 0 \\ -0.5 & 0 & 0.8660 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & -1 \\ 0 & 1 & 0 \end{bmatrix} \\ = \begin{bmatrix} 0.09769 & -0.2126 & 0.272233 \\ 0.1193 & -0.9673 & -0.2235 \\ 0.9880 & 0.1379 & 0.0691 \end{bmatrix}$$

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2.- $\rightarrow y=75^\circ \quad \rightarrow x=60^\circ \quad \rightarrow y=7^\circ$

$$R(x, \alpha) = \begin{bmatrix} \cos \alpha \\ \sin \alpha \end{bmatrix} = \begin{bmatrix} \cos 60^\circ \\ \sin 60^\circ \end{bmatrix} = \begin{bmatrix} 0.5 \\ 0.8660 \end{bmatrix}$$

$$R(y1, \beta) = \begin{bmatrix} -\sin \beta \\ \cos \beta \end{bmatrix} = \begin{bmatrix} -\sin 75^\circ \\ \cos 75^\circ \end{bmatrix} = \begin{bmatrix} -0.9659 \\ 0.2588 \end{bmatrix}$$

$$R(y2, \theta) = \begin{bmatrix} -\sin \theta \\ \cos \theta \end{bmatrix} = \begin{bmatrix} -\sin 7^\circ \\ \cos 7^\circ \end{bmatrix} = \begin{bmatrix} -0.1218 \\ 0.9925 \end{bmatrix}$$

$$T = \text{Roty2}(\theta) \text{Rotx}(\alpha) \text{Roty1}(\beta) =$$

$$\begin{bmatrix} -0.1218 \\ 0.9925 \end{bmatrix} \begin{bmatrix} 0.5 \\ 0.8660 \end{bmatrix} \begin{bmatrix} -0.9659 \\ 0.2588 \end{bmatrix}$$

$$= \begin{bmatrix} 0.0588 \\ -0.0157 \end{bmatrix}$$

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3.- $\rightarrow z=45^\circ \rightarrow x=35^\circ \rightarrow z=15^\circ$

$$R(x, \alpha) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos \alpha & -\sin \alpha \\ 0 & \sin \alpha & \cos \alpha \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos 35^\circ & -\sin 35^\circ \\ 0 & \sin 35^\circ & \cos 35^\circ \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0.8191 & -0.5735 \\ 0 & 0.5735 & 0.8191 \end{bmatrix}$$

$$R(z1, \beta) = \begin{bmatrix} \cos \theta & -\sin \theta & 0 \\ \sin \theta & \cos \theta & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} \cos 45^\circ & -\sin 45^\circ & 0 \\ \sin 45^\circ & \cos 45^\circ & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 0.7071 & -0.7071 & 0 \\ 0.7071 & 0.7071 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$R(2z, \theta) = \begin{bmatrix} \cos \theta & -\sin \theta & 0 \\ \sin \theta & \cos \theta & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} \cos 15^\circ & -\sin 15^\circ & 0 \\ \sin 15^\circ & \cos 15^\circ & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 0.9659 & -0.2588 & 0 \\ 0.2588 & 0.9659 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$T = Rotz2(\theta) Rotx(\alpha) Rotz1(\beta) =$$

$$\begin{bmatrix} 0.9659 & -0.2588 & 0 \\ 0.2588 & 0.9659 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0.8191 & -0.5735 \\ 0 & 0.5735 & 0.8191 \end{bmatrix} \begin{bmatrix} 0.7071 & -0.7071 & 0 \\ 0.7071 & 0.7071 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} -0.1498 & 0.5330 & 0.1484 \\ 0.5594 & 0.7424 & -0.5539 \\ 0.4055 & 0.4055 & 0.8191 \end{bmatrix}$$

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4.- $\rightarrow z=15^\circ \quad \rightarrow x=35^\circ \quad \rightarrow z=45^\circ$

$$R(x, \alpha) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos \alpha & -\sin \alpha \\ 0 & \sin \alpha & \cos \alpha \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos 35^\circ & -\sin 35^\circ \\ 0 & \sin 35^\circ & \cos 35^\circ \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0.8191 & -0.5735 \\ 0 & 0.5735 & 0.8191 \end{bmatrix}$$

$$R(z1, \beta) = \begin{bmatrix} \cos \theta & -\sin \theta & 0 \\ \sin \theta & \cos \theta & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} \cos 45^\circ & -\sin 45^\circ & 0 \\ \sin 45^\circ & \cos 45^\circ & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 0.7071 & -0.7071 & 0 \\ 0.7071 & 0.7071 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$R(2z, \theta) = \begin{bmatrix} \cos \theta & -\sin \theta & 0 \\ \sin \theta & \cos \theta & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} \cos 15^\circ & -\sin 15^\circ & 0 \\ \sin 15^\circ & \cos 15^\circ & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 0.9659 & -0.2588 & 0 \\ 0.2588 & 0.9659 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$T = Rotz1(\beta) Rotx(\alpha) Rotz2(\theta) =$$

$$\begin{bmatrix} 0.7071 & -0.7071 & 0 \\ 0.7071 & 0.7071 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0.8191 & -0.5735 \\ 0 & 0.5735 & 0.8191 \end{bmatrix} \begin{bmatrix} 0.9659 & -0.2588 & 0 \\ 0.2588 & 0.9659 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 0.1498 & 0.5594 & -0.4055 \\ 0.8328 & 0.3764 & -0.4055 \\ 0.1484 & 0.5539 & 0.8191 \end{bmatrix}$$

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① $x=90^\circ \rightarrow y=30^\circ \rightarrow z=70^\circ$ 21/01/19
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$$R(x, \alpha) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos \alpha & -\sin \alpha \\ 0 & \sin \alpha & \cos \alpha \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos 90^\circ & -\sin 90^\circ \\ 0 & \sin 90^\circ & \cos 90^\circ \end{bmatrix}$$

$$R(y, \beta) = \begin{bmatrix} \cos \beta & 0 & \sin \beta \\ 0 & 1 & 0 \\ -\sin \beta & 0 & \cos \beta \end{bmatrix} = \begin{bmatrix} \cos 30^\circ & 0 & \sin 30^\circ \\ 0 & 1 & 0 \\ -\sin 30^\circ & 0 & \cos 30^\circ \end{bmatrix}$$

$$R(z, \theta) = \begin{bmatrix} \cos \theta & -\sin \theta & 0 \\ \sin \theta & \cos \theta & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} \cos 70^\circ & -\sin 70^\circ & 0 \\ \sin 70^\circ & \cos 70^\circ & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$R(x, \alpha) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & -1 \\ 0 & 1 & 0 \end{bmatrix}$$

$$R(y, \beta) = \begin{bmatrix} 0.8660 & 0 & 0.5 \\ 0 & 1 & 0 \\ -0.5 & 0 & 0.8660 \end{bmatrix}$$

$$R(z, \theta) = \begin{bmatrix} 0.3420 & -0.9396 & 0 \\ 0.9396 & 0.3420 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$T = Rot_z(\theta) Rot_y(\beta) Rot_x(\alpha)$$

$$\begin{bmatrix} 0.3420 & -0.9396 & 0 \\ 0.9396 & 0.3420 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 0.8660 & 0 & 0.5 \\ 0 & 1 & 0 \\ -0.5 & 0 & 0.8660 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & -1 \\ 0 & 1 & 0 \end{bmatrix} =$$

PHOTOS

90F = 5

90F = 5

90F = 5

PHOTOS

0.09769	-0.2126	0.272233
0.1193	-0.9673	-0.2235
0.9880	0.1379	0.0691

② $y = 75^\circ \rightarrow x = 60^\circ \rightarrow y = 7^\circ$

$$R(x, \alpha) = \begin{bmatrix} \cos 60^\circ \\ \sin 60^\circ \end{bmatrix} = \begin{bmatrix} 0.5 \\ 0.8660 \end{bmatrix}$$

$$R(y, \beta) = \begin{bmatrix} -\sin 75^\circ \\ \cos 75^\circ \end{bmatrix} = \begin{bmatrix} -0.9659 \\ 0.2588 \end{bmatrix}$$

$$R(y, \theta) = \begin{bmatrix} -\sin 7^\circ \\ \cos 7^\circ \end{bmatrix} = \begin{bmatrix} -0.1218 \\ 0.9925 \end{bmatrix}$$

$$P = \text{Rot}_y(\theta) \text{Rot}_x(\alpha) \text{Rot}_y(\beta)$$

$$\begin{bmatrix} -0.1218 \\ 0.9925 \end{bmatrix} \begin{bmatrix} 0.5 \\ 0.8660 \end{bmatrix} \begin{bmatrix} -0.9659 \\ 0.2588 \end{bmatrix} = \begin{bmatrix} 0.0588 \\ -0.0157 \end{bmatrix}$$

③ $z = 45^\circ \rightarrow x = 35^\circ \rightarrow z = 15^\circ$

$$R(x, \alpha) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos 35^\circ & -\sin 35^\circ \\ 0 & \sin 35^\circ & \cos 35^\circ \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0.8191 & -0.5735 \\ 0 & 0.5735 & 0.8191 \end{bmatrix}$$

$$R(z, \beta) = \begin{bmatrix} \cos 45^\circ & -\sin 45^\circ & 0 \\ \sin 45^\circ & \cos 45^\circ & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 0.7071 & -0.7071 & 0 \\ 0.7071 & 0.7071 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$R(z, \theta) = \begin{bmatrix} \cos 15^\circ & -\sin 15^\circ & 0 \\ \sin 15^\circ & \cos 15^\circ & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 0.9659 & -0.2588 & 0 \\ 0.2588 & 0.9659 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$P = R_0 + z(\theta) R_0 + x(\alpha) R_0 + z(\beta)$$

$$\begin{bmatrix} 0.9659 & -0.2588 & 0 \\ 0.2588 & 0.9659 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0.8191 & -0.5735 \\ 0 & 0.5735 & 0.8191 \end{bmatrix} \begin{bmatrix} 0.7071 & -0.7071 & 0 \\ 0.7071 & 0.7071 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} -0.1498 & 0.5330 & 0.1484 \\ 0.5594 & 0.7424 & -0.5539 \\ 0.4055 & 0.4055 & 0.8191 \end{bmatrix}$$

$$\textcircled{4} \quad z = 15^\circ \rightarrow x = 35^\circ \rightarrow z = 45^\circ$$

$$P = \text{Rot} z_1(\beta) \text{Rot} x(\alpha) \text{Rot} z_2(\theta)$$

$$\begin{bmatrix} 0.7071 & -0.7071 & 0 \\ 0.7071 & 0.7071 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0.8191 & -0.5735 \\ 0 & 0.5735 & 0.8191 \end{bmatrix} \begin{bmatrix} 0.9659 & -0.2588 & 0 \\ 0.2588 & 0.9659 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 0.1498 & 0.5594 & -0.4055 \\ 0.8328 & 0.3764 & -0.4055 \\ 0.1484 & 0.5539 & 0.8191 \end{bmatrix}$$