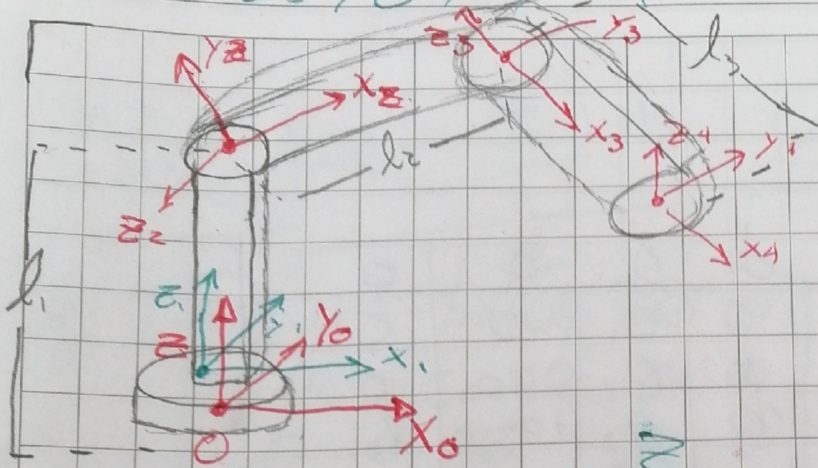
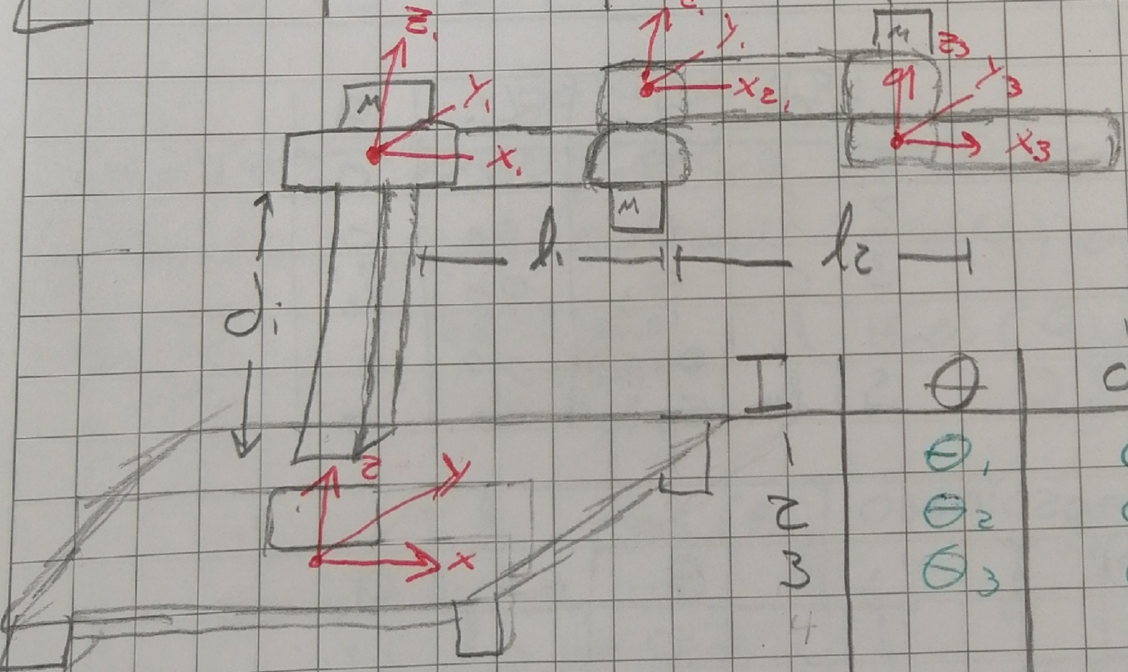
Martes /24/9/19

Fabian Canales

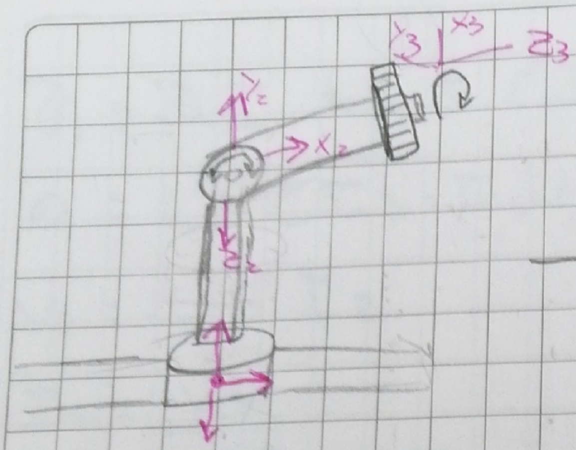


	Z		X	
Eje.	θ_i	d_{i-1}	α_{i-1}	a_i
1	θ_1	0	0	0
2	θ_2	l_1	90	0
3	θ_3	0	0	l_2
4	θ_4	0	0	l_3

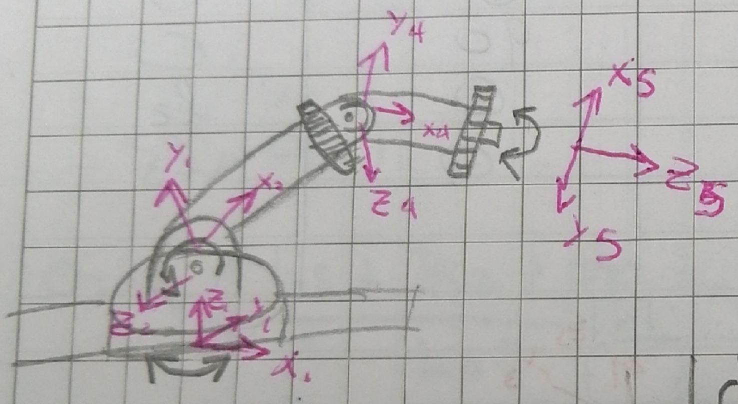


I	θ	d_{i-1}	α_{i-1}	a
1	θ_1	d_1	0	0
2	θ_2	d_2	0	l_1
3	θ_3	d_3	0	l_2

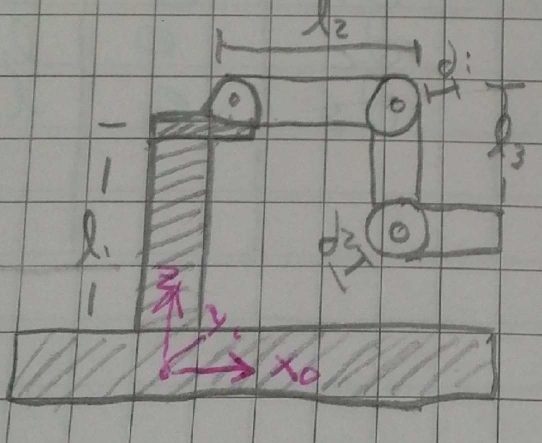
Martes / 1 / 10 / 19



i	d_i	θ_{i-1}	α_{i-1}	a
1	0	θ_1	0	0
2	l_1	θ_2	90	0
3	0	$\theta_3 + 90$	$+90-90$	l_2



i	d_i	θ_{i-1}	α_{i-1}	a
1	0	θ	0	0
2	l_1	θ_2	90	0
3	0	θ_3 90	90	l_2
4	l_3	$\theta+90$	90	0
5	l_4	θ_5-90	0	0



i	d_i	θ_{i-1}	α_{i-1}	a
1	l_1	θ_1	90	l_2
2	d_1	$\theta_2 - 90$	0	l_2
3	d_2	$\theta - 90$	0	l_3

$$H_{i=1} = \underbrace{H_{Rz_{i-1}}(\theta_i)\, H_{Tz_{i-1}}(d_i(\beta_i))}\, \underbrace{H_{Tx_{i-1}}(l_i)\, H_{B_{i-1}}(\alpha_i)}$$

$$H_{i-1} = \begin{bmatrix} \cos(\theta_i) & -\sin(\theta_i) & 0 & 0 \\ \sin(\theta_i) & \cos(\theta_i) & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & d_i(\beta_i) \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 0 & 0 & l_i \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos(\alpha_i) & -\sin(\alpha_i) & 0 \\ 0 & \sin(\alpha_i) & \cos(\alpha) & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

Rotació (R)

$$\begin{bmatrix} \cos(\theta_i) & -\sin(\theta_i)\cos(\alpha) & \sin(\theta_i)\sin(\alpha_i) \\ \sin(\theta_i) & \cos(\theta)\cos(\alpha) & -\cos(\theta_i)\sin(\alpha_i) \\ 0 & \sin(\alpha_i) & \cos(\alpha_i) \end{bmatrix}$$ Complemento de 0's

$$[0 \quad 0 \quad 0]$$

$$\begin{bmatrix} l_i \cos(\theta_i) \\ l_i \sin(\theta_i) \\ d_i(\beta_i) \end{bmatrix}$$ desplazamiento

$$[1]$$

Complemento 1

Robot 1

eje	θ_i	d_{i-1}	α_{i-1}	a_i
1	θ_1	0	0	0
2	θ_2	l_1	90	0
3	θ_3	0	0	l_2
4	θ_4	0	0	l_3

$$T_1 = \begin{bmatrix} C\theta_1 & -S\theta_1 C\alpha_1 & S\theta_1 S\theta_1 & \theta C\theta_1 \\ S\theta_1 & C\theta C_1 & C\theta_1 S\theta & \theta S\theta_1 \\ 0 & S\theta & C\theta & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

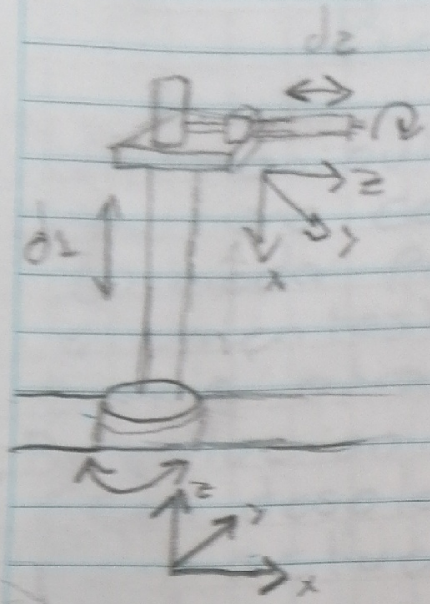
$$T_1 = \begin{bmatrix} C\theta_1 & -S\theta_1 & 0 & 0 \\ S\theta_1 & C\theta_1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$T4 = \begin{bmatrix} C\theta_4 & -S\theta_4 & 0 & l_3 C\theta_4 \\ S\theta_4 & -C\theta_4 & 0 & l_3 S\theta_4 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$T2 = \begin{bmatrix} C\theta_2 & 0 & S\theta_2 & 0 \\ S\theta_2 & 0 & -C\theta_2 & 0 \\ 0 & 1 & 0 & l_1 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

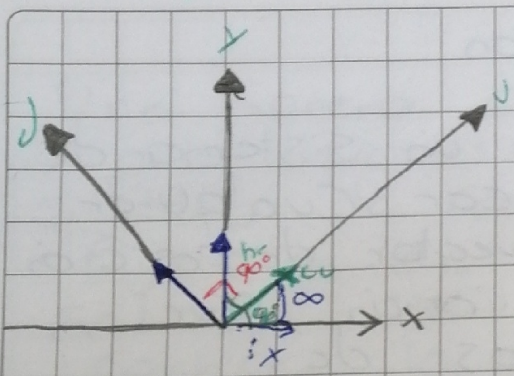
$$T3 = \begin{bmatrix} C\theta_3 & -S\theta_3 & 0 & l_2 C\theta_3 \\ S\theta_3 & C\theta_3 & 0 & l_2 S\theta_3 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Fabian Canales Ochoa 11/10/19



i	di	θ_{i-1}	α_{i-1}	a
1	θ	0	0	0
2	0	d_i	0	0
3				
4				

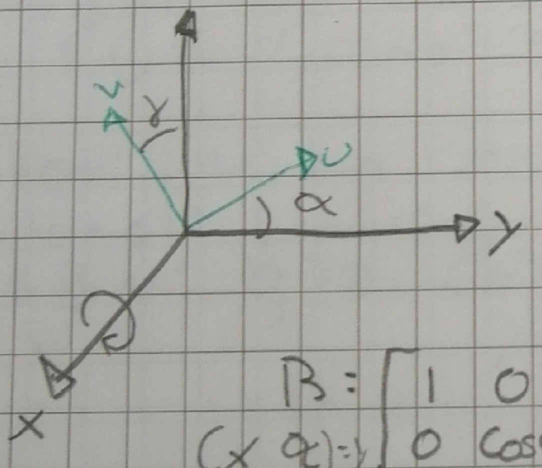
Martes/10/9/19



$$P_x = [P_x \; P_y]^T = P_x i_x + P_y j_y$$

$$P(uv) = [P_u \; P_v]^1 = P_u i_u + P_v \cdot l_v$$

$$\begin{bmatrix} P_x \\ P_y \end{bmatrix} = B \begin{bmatrix} P_u \\ P_v \end{bmatrix} = \begin{bmatrix} i_x i_y & i_x j_v \\ i_x j_u & j_v l_u \end{bmatrix} = \begin{bmatrix} \cos\alpha & -\operatorname{sen}\alpha \\ \operatorname{sen}\alpha & \cos\alpha \end{bmatrix}$$



$$B(x, \alpha) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\alpha & -\operatorname{sen}\alpha \\ 0 & \operatorname{sen}\alpha & \cos\alpha \end{bmatrix} \; y$$

$$B(y, \varphi) = \begin{bmatrix} \cos & 0 & \operatorname{sen}\varphi \\ 0 & 1 & 0 \\ -\operatorname{sen} & 0 & \cos\varphi \end{bmatrix} \; x$$

$$B(z, \phi) \begin{bmatrix} \cos\phi & -\operatorname{sen}\theta & 0 \\ \operatorname{sen}\phi & \cos\phi & 0 \\ 0 & 0 & 1 \end{bmatrix} \; z$$

$T = R_y\ R_y\ R_z$

Realizar las traslacion de:

1. 90
2. 30
3. 45
4. 65
5. 75
6. 110
7. 32
8. 27
9. 150
10. 270

$T = R_{x1}\ R_{z3}\ R_{y5}$

$T = R_{x7}\ R_{z9}\ R_{x2}$

$T = R_{x10}\ R_{y4}\ R_{z6}$

$T = R_{y8}\ R_{x9}\ R_{y2}$

$T = R_{y2}\ R_{x9}\ R_{y8}$

$T = R_{z6}\ R_{y4}\ R_{z2}$

$T = R_{x2}\ R_{y3}\ R_{z4}$

$T = R_{x1}\ R_{y1}\ R_{z6}$

$T = R_{z7}\ R_{y5}\ R_{x9}$

$T = R_{z10}\ R_{y10}\ R_{z2}$

$$
B = \overset{X}{\begin{bmatrix} \cos(90) & 0 & \operatorname{sen}(90) \\ 0 & 1 & 0 \\ -\operatorname{sen}(90) & 0 & \cos(90) \end{bmatrix}} \times \overset{Z}{\begin{bmatrix} \cos(45) & -\operatorname{sen}(45) & 0 \\ \operatorname{sen}(45) & \cos(45) & 0 \\ 0 & 0 & 1 \end{bmatrix}} \times \overset{Y}{\begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(75) & -\operatorname{sen}(75) \\ 0 & \operatorname{sen}(75) & \cos(75) \end{bmatrix}}
$$

$$
= \begin{matrix} 0.4842 & -0.6981 & 0.5274 \\ -0.8509 & -0.2354 & 0.4696 \\ -0.2037 & -0.6762 & -0.7080 \end{matrix}
$$

$$
B = \begin{bmatrix} \cos(32) & 0 & \operatorname{sen}(32) \\ 0 & 1 & 0 \\ -\operatorname{sen}(32) & 0 & \cos(32) \end{bmatrix} \times \begin{bmatrix} \cos(150) & -\operatorname{sen}(150) & 0 \\ \operatorname{sen}(150) & \cos(150) & 0 \\ 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} \cos(30) & 0 & \operatorname{sen}(30) \\ 0 & 1 & 0 \\ -\operatorname{sen}(30) & 0 & \cos(30) \end{bmatrix}
$$

$$
= \begin{matrix} 0.69 & -0.59 & -0.39 \\ 0.11 & 0.63 & -0.76 \\ 0.70 & 0.49 & 0.50 \end{matrix}
$$

$$
B = \begin{bmatrix} \cos(270) & 0 & \operatorname{sen}(270) \\ 0 & 1 & 0 \\ -\operatorname{sen}(270) & 0 & \cos(270) \end{bmatrix} \times \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(65) & -\operatorname{sen}(65) \\ 0 & \operatorname{sen}(65) & \cos(65) \end{bmatrix} \times \begin{bmatrix} \cos(110) & -\operatorname{sen}(110) & 0 \\ \operatorname{sen}(110) & \cos(110) & 0 \\ 0 & 0 & 1 \end{bmatrix}
$$

$$
= \begin{matrix} 0.5619 & 0.10 & 0.82 \\ -0.02 & -0.98 & 0.13 \\ 0.82 & -0.09 & -0.55 \end{matrix}
$$

$$
B = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(27) & -\operatorname{sen}(27) \\ 0 & \operatorname{sen}(27) & \cos(27) \end{bmatrix} \times \begin{bmatrix} \cos(150) & 0 & \operatorname{sen}(50) \\ 0 & 1 & 0 \\ -\operatorname{sen}(150) & 0 & \cos(150) \end{bmatrix} \times \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(30) & -\operatorname{sen}(30) \\ 0 & \operatorname{sen}(30) & \cos(30) \end{bmatrix}
$$

$$
= \begin{matrix} 0.61 & 0.70 & -0.34 \\ -0.68 & 0.69 & 0.20 \\ 0.39 & 0.11 & 0.91 \end{matrix}
$$

X

$$B = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(30) & -\text{Sen}(30) \\ 0 & \text{Sen}(30) & \cos(30) \end{bmatrix} \times \begin{bmatrix} \cos(150) & 0 & \text{Sen}(150) \\ 0 & 1 & 0 \\ -\text{Sen}(150) & 0 & \cos(150) \end{bmatrix} \times \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(27) & -\text{Sen}(27) \\ 0 & \text{Sen}(27) & \cos(27) \end{bmatrix}$$

$$= \begin{matrix} 0.61 & -0.68 & -0.39 \\ 0.70 & 0.69 & -0.11 \\ 0.37 & -0.20 & 0.91 \end{matrix}$$

$$B = \begin{bmatrix} \cos(110) & -\text{Sen}(110) & 0 \\ \text{Sen}(110) & \cos(110) & 0 \\ 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(65) & -\text{Sen}(65) \\ 0 & \text{Sen}(65) & \cos(65) \end{bmatrix} \times \begin{bmatrix} \cos(20) & -\text{Sen}(20) & 0 \\ \text{Sen}(20) & \cos(20) & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{matrix} 0.04 & 0.99 & -0.12 \\ 0.56 & -0.12 & -0.81 \end{matrix} \quad \begin{matrix} -0.82 & -0.03 & -0.56 \end{matrix}$$

$$B = \begin{bmatrix} \cos(20) & 0 & \text{Sen}(20) \\ 0 & 1 & 0 \\ -\text{Sen}(20) & 0 & \cos(20) \end{bmatrix} \times \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(45) & -\text{Sen}(45) \\ 0 & \text{Sen}(45) & \cos(45) \end{bmatrix} \times \begin{bmatrix} \cos(65) & -\text{Sen}(65) & 0 \\ \text{Sen}(65) & \cos(65) & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{matrix} -0.29 & 0.60 & -0.74 \\ -0.43 & 0.66 & 0.66 \\ 0.85 & 0.51 & 0.08 \end{matrix}$$

$$B = \begin{bmatrix} \cos(90) & 0 & \text{Sen}(90) \\ 0 & 1 & 0 \\ -\text{Sen}(90) & 0 & \cos(90) \end{bmatrix} \times \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(90) & -\text{Sen}(90) \\ 0 & \text{Sen}(90) & \cos(90) \end{bmatrix} \times \begin{bmatrix} \cos(110) & -\text{Sen}(110) \\ \text{Sen}(110) & \cos(110) \\ 0 & 0 \end{bmatrix}$$

$$= \begin{matrix} 0.44 & -0.77 & -0.43 \\ -0.01 & 0.48 & -0.87 \\ 0.89 & 0.40 & 0.20 \end{matrix}$$

$$B = \begin{bmatrix} \cos(32) & -\text{sen}(32) & 0 \\ \text{sen}(32) & \cos(32) & 0 \\ 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(75) & -\text{sen}(75) \\ 0 & \text{sen}(75) & \cos(75) \end{bmatrix} \times \begin{bmatrix} \cos(150) & 0 & \text{sen}(150) \\ 0 & 1 & 0 \\ -\text{sen}(150) & 0 & \cos(150) \end{bmatrix}$$

$$= \begin{matrix} 0.76 & 0.50 & 0.38 \\ -0.15 & 0.73 & -0.65 \\ -0.62 & 0.44 & 0.64 \end{matrix}$$

$$B = \begin{bmatrix} \cos(270) & -\text{sen}(270) & 0 \\ \text{sen}(270) & \cos(270) & 0 \\ 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(270) & -\text{sen}(270) \\ 0 & \text{sen}(270) & \cos(270) \end{bmatrix} \times \begin{bmatrix} \cos(30) & -\text{sen}(30) & 0 \\ \text{sen}(30) & \cos(30) & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{matrix} -0.02 & -0.99 & 0.02 \\ 0.9 & -0.01 & 0.17 \\ -0.17 & 0.03 & 0.98 \end{matrix}$$

Robot soporte 500gr

3 grados de libertad

50cm

30cm

Instalación de Ro

Reporte proyecto 1

Altium

Orcad

Gummi

jabret

PDF

lyx

latex → lyx →

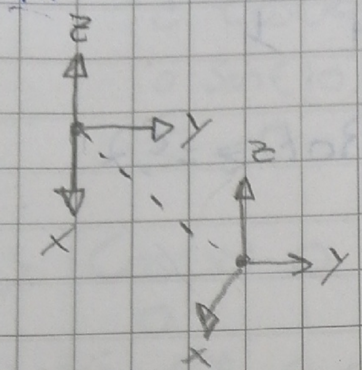
gits

C.Tex

6.6

$$H = \begin{bmatrix} R & P \\ C^T & 1 \end{bmatrix}$$

R



$$H = \begin{bmatrix} R(x, \alpha) & P \\ C^T & 1 \end{bmatrix}$$

$$\begin{bmatrix} P_x \\ P_y \\ P_z \end{bmatrix}$$

R

$$H_x = \begin{bmatrix} 1 & 0 & 0 & 30 \\ 0 & \cos(30) & -\mathrm{Sen}(30) & 50 \\ 0 & \mathrm{Sen}(30) & \cos(30) & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

→ Posición

C^T

$$H_y \begin{bmatrix} \cos 30 & 0 & \mathrm{Sen}\,30 & 30 \\ 0 & 1 & 0 & 30 \\ -\mathrm{Sen}\,30 & 0 & \cos 30 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$H_T = H_x H_y H_z$$

$$H_T = \begin{bmatrix} 1 & 0 & 0 & 30 \\ 0 & \cos 30 & -S30 & 50 \\ 0 & \mathrm{Sen}30 & C30 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} C30 & 0 & \mathrm{Sen}30 & 30 \\ 0 & 1 & 0 & 50 \\ -S30 & 0 & C30 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Si abx Rot $x = ?_1$ y mover

$x = ?_2$ y $y = ?_3$ Rot $y = ?_4$ y

desplazamiento $x = ?_5$ $z = ?_6$ Rot $z = ?_7$

	1	2	3	4
$?_1$ =	30	10	7	9
$?_2$:	40	5	5	0
$?_3$ =	50	3	3	1
$?_4$ =	60	12	0	9
$?_5$:	70	30	3	10
$?_6$:	80	20	20	10
$?_7$ =	90	9	50	30

$$H_x \begin{bmatrix} 1 & 0 & 0 & 40 \\ 0 & \cos(30) & \text{sen}(30) & 50 \\ 0 & \text{sen}(30) & \cos(30) & 0 \\ 0 & 0 & 1 & 1 \end{bmatrix}$$

$$H_y \begin{bmatrix} \cos 60 & 0 & \text{Sen}60 & 70 \\ 0 & 1 & 0 & 0 \\ -\text{Sen}60 & 0 & \cos 60 & 90 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad H_z \begin{bmatrix} \cos 90 & -\text{Sen}90 & 0 & 0 \\ \text{Sen}90 & \cos 90 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 \end{bmatrix}$$

$$H_x \begin{bmatrix} 1 & 0 & 0 & 5 \\ 0 & \cos(10) & \operatorname{Sen}(10) & 3 \\ 0 & \operatorname{Sen}(10) & \cos(10) & 0 \\ 0 & 0 & 1 & 1 \end{bmatrix} \quad H_T:$$

$$H_y \begin{bmatrix} \cos(12) & 0 & \operatorname{Sen}(12) & 30 \\ 0 & 1 & 0 & 0 \\ -\operatorname{Sen}(12) & 0 & \cos(12) & 9 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad H_z \begin{bmatrix} \cos(9) & -\operatorname{Sen} 90 & 0 & 0 \\ \operatorname{Sen}(9) & \cos 90 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 \end{bmatrix}$$

$$H_x \begin{bmatrix} 1 & 0 & 0 & 5 \\ 0 & \cos 7 & \operatorname{Sen} 7 & 3 \\ 0 & \operatorname{Sen} 7 & \cos 7 & 0 \\ 0 & 0 & 1 & 1 \end{bmatrix} \quad HT =$$

$$H_y \begin{bmatrix} \cos 0 & 0 & \operatorname{Sen} 0 & 3 \\ 0 & 1 & 0 & 0 \\ -\operatorname{Sen} 0 & 0 & \cos 60 & 50 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad H_z \begin{bmatrix} \cos 50 & -\operatorname{Sen} 50 & 0 & 0 \\ \operatorname{Sen} 50 & \cos 50 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 \end{bmatrix}$$