



TAREA: MATRICES ROBOTS

Cinemática De Robots



23 DE FEBRERO DE 2019
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8.-B T/M

Robot 1

```
[cos(theta3)*(cos(theta2)*cos(theta) - sin(theta2)*sin(theta)) -  
2*cos(theta)*sin(theta3)*sin(theta), -  
sin(theta3)*(cos(theta2)*cos(theta) - sin(theta2)*sin(theta)) -  
2*cos(theta3)*cos(theta)*sin(theta), 0, -l2*(cos(theta2)*cos(theta) -  
sin(theta2)*sin(theta)) + l1*cos(theta)]  
  
[cos(theta2)*sin(theta3), cos(theta3) + cos(theta2)*cos(theta3), 1, 0]  
  
[ - sin(theta3)*(cos(theta)^2 - sin(theta)^2) -  
cos(theta3)*(cos(theta2)*sin(theta) + cos(theta)*sin(theta2)),  
sin(theta3)*(cos(theta2)*sin(theta) + cos(theta)*sin(theta2)) -  
cos(theta3)*(cos(theta)^2 - sin(theta)^2), 0, -  
l2*(cos(theta2)*sin(theta) + cos(theta)*sin(theta2)) - l1*sin(theta)]  
[0, 0, 0, 1]
```

Robot 2

```
[cos(theta1)*cos(theta2)*cos(theta) - cos(theta)*sin(theta1)*sin(theta2), -cos(theta2)*sin(theta)  
- cos(theta1)*cos(theta)*sin(theta2) - cos(theta2)*cos(theta)*sin(theta1), -sin(theta),  
l1*cos(theta) + l2*cos(theta1)*cos(theta)]  
  
[0, 0, 0, 0]  
  
[sin(theta1)*sin(theta2)*sin(theta) - cos(theta1)*cos(theta2)*sin(theta),  
cos(theta1)*sin(theta2)*sin(theta) - cos(theta2)*cos(theta) + cos(theta2)*sin(theta1)*sin(theta), -  
cos(theta), -l1*sin(theta) - l2*cos(theta1)*sin(theta)]  
  
[0, 0, 0, 1]
```

Robot 3

```
[sin(theta2)*sin(theta) + cos(theta1)*cos(theta2)*cos(theta), cos(theta2)*sin(theta) -  
cos(theta1)*cos(theta)*sin(theta2), -cos(theta)*sin(theta1), l1*cos(theta)]  
  
[-cos(theta2)*sin(theta1), sin(theta1)*sin(theta2), 0, 0]  
  
[cos(theta)*sin(theta2) - cos(theta1)*cos(theta2)*sin(theta), cos(theta2)*cos(theta) +  
cos(theta1)*sin(theta2)*sin(theta), sin(theta1)*sin(theta), -l1*sin(theta)]  
  
[0, 0, 0, 1]
```

Robot 4

```
[cos(theta1)*cos(theta2)*cos(theta) - cos(theta)*sin(theta1)*sin(theta2), cos(theta2)*sin(theta) -  
cos(theta1)*cos(theta)*sin(theta2) - cos(theta2)*cos(theta)*sin(theta1), 0, l*sin(theta)]  
  
[sin(theta1)*sin(theta2)*sin(theta) - cos(theta1)*cos(theta2)*sin(theta), cos(theta2)*cos(theta) +  
cos(theta1)*sin(theta2)*sin(theta) + cos(theta2)*sin(theta1)*sin(theta), 0, l*cos(theta)]  
  
[cos(theta1)*sin(theta2) + cos(theta2)*sin(theta1), cos(theta1)*cos(theta2) -  
cos(theta2)*cos(theta) - sin(theta1)*sin(theta2), 0, -l*cos(theta)]
```

[0,0, 0,1]

Robot 5

[cos(theta1)*cos(theta2)*cos(theta) - cos(theta)*sin(theta1)*sin(theta2), cos(theta)*sin(theta) - cos(theta1)*cos(theta)*sin(theta2) - cos(theta2)*cos(theta)*sin(theta1), sin(theta), d2*sin(theta) + l1*cos(theta1)*cos(theta)]

[0,0,0,0]

[0,0,0,0]

[0,0,0,1]

Robot 6

[cos(theta1)*cos(theta2)*cos(theta) - sin(theta)^2, - cos(theta)*sin(theta) - cos(theta1)*cos(theta)*sin(theta2), -cos(theta)*sin(theta1), l1 - d2*sin(theta) + l1*cos(theta1)*cos(theta)]

[cos(theta)*sin(theta) + cos(theta1)*cos(theta2)*sin(theta), cos(theta)^2 - cos(theta1)*sin(theta2)*sin(theta), -sin(theta1)*sin(theta), d2*cos(theta) + l1*cos(theta1)*sin(theta)]

[0,0,0,0]

[0,0,0,1]

Jesus Alberto Garcia Canacho - 12-02-2019 - 8:13-T/M

Calculo De Matrices Homogeneas

$$T_i^{i-1} = \begin{bmatrix} C\theta_i & -S\theta_i & 0 & a_{i-1} \\ S\theta_i C\alpha_{i-1} & C\theta_i C\alpha_{i-1} & -S\alpha_{i-1} & -d_i S\alpha_{i-1} \\ S\theta_i S\alpha_{i-1} & C\theta_i S\alpha_{i-1} & C\alpha_{i-1} & d_i C\alpha_{i-1} \\ 0 & 0 & 0 & 0 \end{bmatrix} = \begin{bmatrix} C\theta_i & -S\theta_i & 0 & 0 \\ 0 & 0 & 1 & 0 \\ -S\theta_i & -C\theta_i & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

i	a_{i-1}	α_{i-1}	d_i	θ_i
1	0	-90	0	θ_1
2	L_1	0	0	θ_2
3	L_2	0	0	θ_3

$$T_i^1 = \begin{bmatrix} C\theta_2 & -S\theta_2 & 0 & 0 \\ S\theta_2 & C\theta_2 & 0 & 0 \\ 0 & C\theta_2 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$T_3^2 = \begin{bmatrix} C\theta_3 & -S\theta_3 & 0 & L_2 \\ S\theta_3 & C\theta_3 & 0 & 0 \\ 0 & C\theta_3 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$T_{11} = \begin{bmatrix} [C\theta_2 \times (C\theta_1 \times C\theta_3 - S\theta_1 \times S\theta_3) - 2 \times (C\theta_2 \times S\theta_1 \times S\theta_3 + C\theta_1 \times C\theta_3 \times S\theta_2 - 2 \times C\theta_3 \times C\theta_1 \times S\theta_2 + 0 \times L_2 \times C\theta_1) \\ S\theta_1 \times (C\theta_2 \times S\theta_3) + L_1 \times C\theta_1 \\ [C\theta_2 \times S\theta_3 + S\theta_2 \times C\theta_3 + C\theta_2 \times C\theta_1 \times 1, 0] \\ [-S\theta_1 \times (C\theta_2 \times S\theta_3) - (C\theta_2 \times (C\theta_1 \times S\theta_3 + C\theta_3 \times S\theta_1), S\theta_2 \times (C\theta_2 \times S\theta_3 + C\theta_1 \times S\theta_2) - C\theta_1 \times (C\theta_2 \times S\theta_3 + C\theta_3 \times S\theta_1) - C\theta_3 \times (C\theta_1^2 - S\theta_1^2), 0, -L_2 \times (C\theta_2 \times S\theta_3 + C\theta_1 \times S\theta_2) - L_1 \times S\theta_1] \\ [0, 0, 0, 1] \end{bmatrix}$$

$$T_1^2 = \begin{bmatrix} C\theta_2 & -S\theta_2 & 0 & 0 \\ S\theta_2 & C\theta_2 & 0 & 0 \\ 0 & C\theta_2 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad T_2^2 = \begin{bmatrix} C\theta_2 & -S\theta_2 & 0 & L_1 \\ 0 & 0 & 0 & 0 \\ -S\theta_2 & -C\theta_2 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad T_3^2 = \begin{bmatrix} C\theta_3 & -S\theta_3 & 0 & L_2 \\ S\theta_3 & C\theta_3 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$T_{11}^2 = \begin{bmatrix} [C\theta_2 \times (C\theta_1 \times (C\theta_2 \times C\theta_3 - C\theta_1 \times S\theta_2 \times S\theta_3) - C\theta_3 \times S\theta_2 - (C\theta_2 \times C\theta_1 \times S\theta_3 - C\theta_3 \times (C\theta_1 \times S\theta_2) \\ -S\theta_1 \times L_1 \times C\theta_1 + L_2 \times C\theta_2 \times C\theta_1] \\ [0, 0, 0, 0] \end{bmatrix}$$