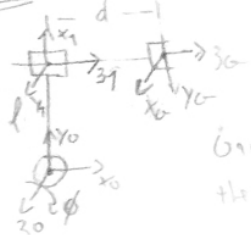
• Lab Work # 2

4) 1) Robô 2

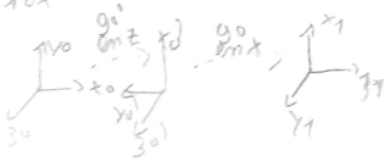


Gripper fixo
theta = 0

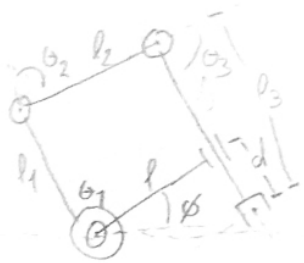
$${}^{0}_{G}T = {}^{0}_{1}T \cdot {}^{1}_{G}T$$

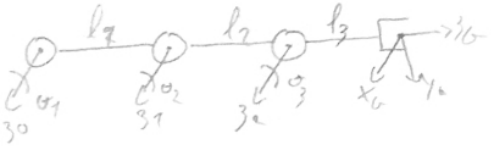
	θ_i	d_i	a_i	d/a_i	offset	Joint type
0→1	ϕ	0	ℓ	90°	90°	R
1→I	0	d	0	0	0°	P
I→G	0	0	0	90	0	R

C.Int



Nota: Quanto ao Robô 1, é igual ao do exercício 2. Portanto vamos considerar os seus parâmetros → ver Ex2.pdf.





2) Cinemática Inversa

Robô 1 – ver exercício 2) R P

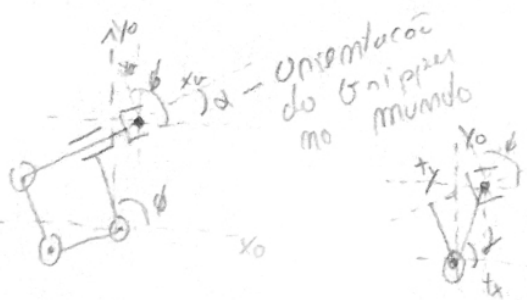
Robô 2: $${}^{0}_{G}T = \begin{bmatrix} 0 & S\phi & C\phi & dC\phi - \ell S\phi \\ 0 & -C\phi & S\phi & \ell C\phi + dS\phi \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} h_x & s_x & a_x & t_x \\ h_y & s_y & a_y & t_y \\ h_z & s_z & a_z & t_z \\ 0 & 0 & 0 & \end{bmatrix}$$

Deforma direcla relinumos

- $\phi = atan2(S\phi, C\phi)$

- $t_x = dC\phi - \ell S\phi$
  $t_y = \ell C\phi - dS\phi$ | Posição do Gripper do Robô

Para que o Robô 1 "siga" o Robô 2 o seu gripper deve ter a mesma orientação e posição:



$\gamma = atan2(t_y, t_x)$

geometricamente: $\alpha_2 = atan2(S\phi, C\phi) - \pi/2$

A igualdade final:

$$\alpha_1 = \alpha_2$$

Robô 1 Robô 2

$t_{x_1} = t_{x_2}$

$t_{y_1} = t_{x_2}$

Agora em função de θ_1, θ_2 e θ_3:

$$\theta_3 = \underbrace{atan2(S_{123}, C_{123})}_{\alpha_1 = \alpha_2} - \theta_2 - \theta_3$$

logo $\theta_3 = atan2(S\phi, C\phi) - \theta_2 - \theta_3$

e $\theta_2 = \pm \arccos\left(\frac{C_{x_2} + t_{y_2}^2 + 3 + 4}{2 \cdot 3 \cdot 4}\right)$ → substituir $\begin{cases} t_{x_1} = t_{x_{EF}} \\ t_{y_1} = t_{y_2} \end{cases}$ em função do vector t nó 2 //

$$\theta_1 = \tan^{-1}\left(\frac{t_{y_2}}{t_{x_2}}\right) - \tan^{-1}\left(\frac{3C_2}{4+3C_2}\right)$$