Position, Orientation & Frame

For object @ (x_p, y_p), theta is calculated using $\cos^{-1}(x_p)$, $\theta_p = \cos^{-1}(x_p)$, then the transition matrix is calculated:

$$T_1 = \begin{bmatrix} \cos(\theta_1) & -\sin(\theta_1) \\ \sin(\theta_1) & \cos(\theta_1) \end{bmatrix}$$

then by multiplying you get the new position vector, which should equal $\begin{bmatrix} x_1 \\ y_1 \end{bmatrix}$.

$$\begin{bmatrix} \cos(\theta_1) & -\sin(\theta_1) \\ \sin(\theta_1) & \cos(\theta_1) \end{bmatrix} \begin{bmatrix} x_0 \\ y_0 \end{bmatrix} = \begin{bmatrix} x_1 \\ y_1 \end{bmatrix},$$

Similar process for placing the arm at (x_2, y_2).

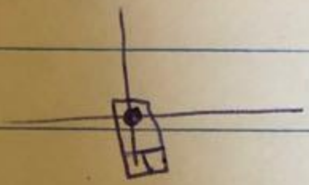
$\theta_2 = \cos^{-1}(x_2)$.

$\theta_{2\text{-relative}} = \theta_2 - \theta_1$ → make sure to adjust for a relative degree

$$T_2 = \begin{bmatrix} \cos(\theta_{2-r}) & -\sin(\theta_{2-r}) \\ \sin(\theta_{2-r}) & \cos(\theta_{2-r}) \end{bmatrix}$$

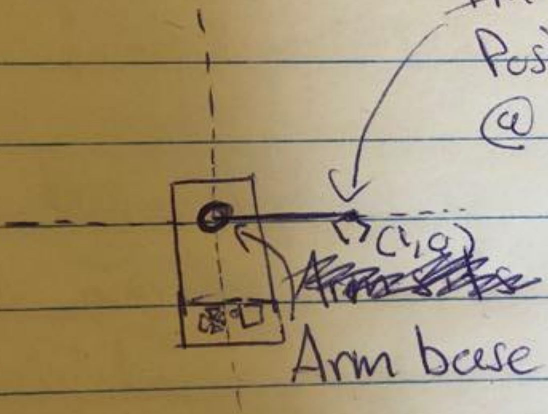
$$\begin{bmatrix} \cos(\theta_{2r}) & -\sin(\theta_{2-r}) \\ \sin(\theta_{2-r}) & \cos(\theta_{2-r}) \end{bmatrix} \begin{bmatrix} x_1 \\ y_1 \end{bmatrix} = \begin{bmatrix} x_2 \\ y_2 \end{bmatrix}$$

Arm in XY plane:



Orientation:

Initial Arm Position rests @ (1,0)



Arm base sits @ (0,0)

Initial Position Vector: $\begin{bmatrix} 1 \\ 0 \end{bmatrix}$

On Unit Circle, this is $\theta = 0°$

Notes by: Joanne Reilly