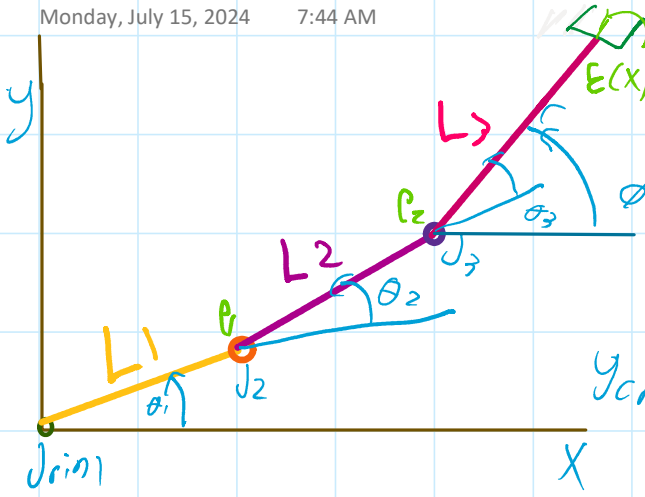
TASK 3 ME Kinematics for 3 degrees of freedom

Monday, July 15, 2024 7:44 AM



ψ = orientation angle

X comp

Link 1. x = L1 cos

link 2. x = L2 cos(θ1 + θ2)

link 3. x = L3 cos(θ1 + θ2 + θ3)

y comp: link 1. y = L1 sinθ

link 2. y = L2 sin(θ1 + θ2)

link 3. y = L3 sin(θ1 + θ2 + θ3)

Forward Kinematics

X comp

$$X = L_1\cos\theta_1 + L_2\cos(\theta_1+\theta_2) + L_3\cos(\theta_1+\theta_2+\theta_3)$$

y comp

$$y = L_1\sin\theta_1 + L_2\sin(\theta_1+\theta_2) + L_3\sin(\theta_1+\theta_2+\theta_3)$$

$$\theta = \theta_1+\theta_2+\theta_3$$

Inverse Kinematics

$$P_{2x} = x - L_3\cos\psi$$

$$P_{2y} = y - L_3\sin\psi$$

getting P2 will get us the remain angles

$$\psi = \theta_1+\theta_2+\theta_3$$

$$\rightarrow \theta_3 = \psi - (\theta_2+\theta_3)$$

$$\theta_1 = \tan^{-1}\frac{y}{x} - \tan^{-1}\frac{L_2\sin\theta_2}{L_1+L_2\cos\theta_2}$$

$$\theta_2 = \cos^{-1}\left[\frac{x^2+y^2-(L_1^2+L_2^2)}{2L_1L_2}\right]$$