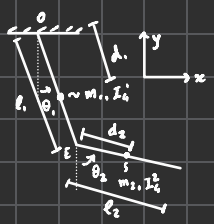
RO2102: Dynamics and Simulation

Tanay Srinivasa
U20220086

Homework-9

Problem 31 **Due : 7 - Apr - 2025** **Time Spent : 3 Hours**

Sketch:



Given: $m_1, I_1', m_2, I_2', d_1, d_2, l_1, l_2, \vec{z}(0)$

To Find: EoM using: a) N-E Minimal
b) Lagrange Equations
c) DAE

a) Apply AMB_O on FBD system

Apply AMB_E on FBD link 2.

b) $E_K = \frac{1}{2} m_1(\vec{v}_1 \cdot \vec{v}_1) + \frac{1}{2} m_2(\vec{v}_2 \cdot \vec{v}_2) + \frac{1}{2} I_1' \dot{\theta}_1^2 + \frac{1}{2} I_2' \dot{\theta}_2^2$

$E_P = m_1 g(\vec{r}_{G1/O} \cdot \hat{j}) + m_2 g(\vec{r}_{G2/O} \cdot \hat{j})$

$\mathcal{L} = E_K - E_P$

Choose minimal co-ordinates: θ_1, θ_2

Solve: $\frac{d}{dt}\frac{\partial \mathcal{L}}{\partial \dot{q}_i} - \frac{\partial \mathcal{L}}{\partial q} = 0$

(c) Apply LMB and AMB_{G1} on FBD link 1.

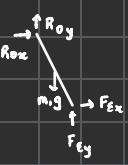
Apply LMB and AMB_{G2} on FBD link 2.

Use constraints: $\vec{V}_O = \vec{V}_O$

$\vec{V}_E = \vec{V}_E$

FBD: system

FBD: link 1



FBD: link 2