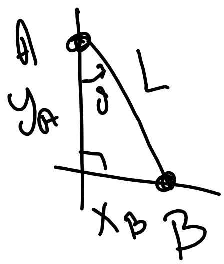
February 14, 2017



1) $L^2 = x_B^2 + y_A^2 \leftarrow$

$$0 = 2x_B\dot{x}_B + 2y_A\dot{y}_A$$

$$\frac{x_B}{y_A} = \tan\theta$$

$$\frac{x_B}{L} = \sin\theta, \quad \frac{y_A}{L} = \cos\theta$$

$$\frac{dy_A^2}{dt} = \frac{d(y_A^2)}{dy_A}\frac{dy_A}{dt}$$

$$= 2y_A\dot{y}_A$$

$$x_B = L\sin\theta, \quad y_A = L\cos\theta$$

$$\dot{x}_B = L\cos\theta\,\dot{\theta}, \quad \dot{y}_A = -L\sin\theta\,\dot{\theta}$$

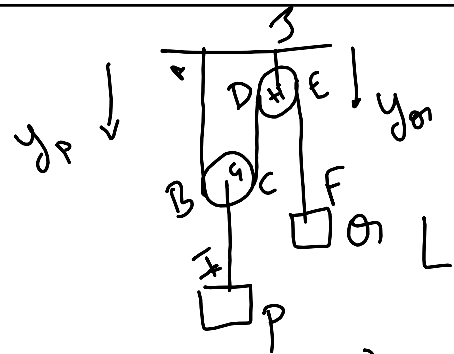
from Before, $0 = \cancel{2}x_B\dot{x}_B + \cancel{2}y_A\dot{y}_A$

$$0 = x_B\dot{x}_B + y_A\dot{y}_A$$

$$0 = \cancel{L}\sin\theta\,\dot{x}_B + \cancel{L}\cos\theta\,\dot{y}_A$$

$$0 = \sin\theta\,\dot{x}_B + \cos\theta\,\dot{y}_A$$

$$\dot{y}_A = -\frac{\sin\theta}{\cos\theta}\dot{x}_B = -\tan\theta\,\dot{x}_B$$



$L =$ constant

$L = AB + Per(G) + CD + Per(H) + EF$

$AB = y_p - GI$

$CD = y_p - GI - HJ$

$EF = y_m - HJ$

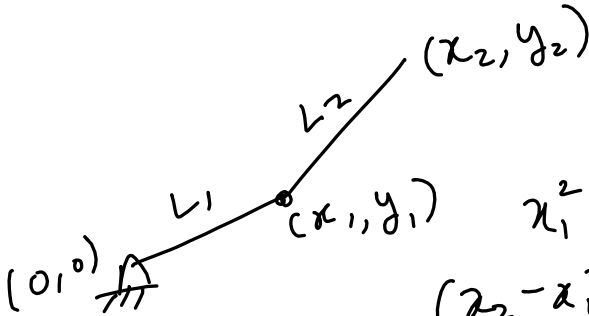
$L = (y_p - GI) + Per(G) + (y_p - HJ - GI) + Per(H) + (y_m - HJ)$

$L = 2y_p + y_m - 2GI - 2HJ + Per(G) + Per(H)$

$0 = 2\dot{y}_p + \dot{y}_m$

$0 = 2V_p + V_m \;// \Rightarrow 0 = 2\dot{V}_p + \dot{V}_m$

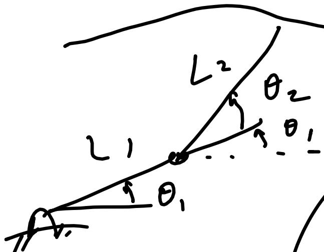
$0 = 2a_p + a_m \;//$



x_1, y_1, x_2, y_2

$$x_1^2 + y_1^2 = L_1^2$$

$$(x_2 - x_1)^2 + (y_2 - y_1)^2 = L_2^2$$



θ_1, θ_2,

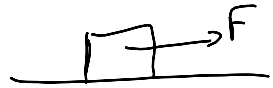
$$x_1 = L_1 \cos\theta_1$$

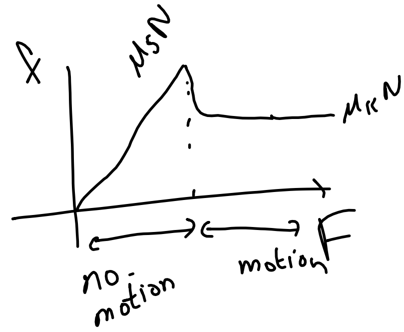
$$y_1 = L_1 \sin\theta_1$$

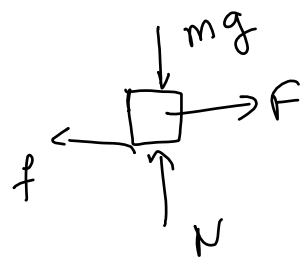
Generalized coordinates

$$x_2 = L_1 \cos\theta_1 + L_2 \cos(\theta_1 + \theta_2)$$

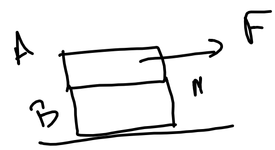
$$y_2 = L_1 \sin\theta_1 + L_2 \sin(\theta_1 + \theta_2)$$

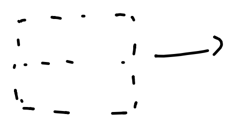


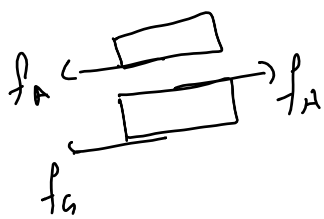


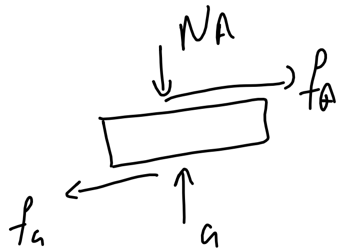


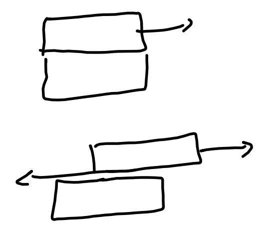
AB
BG

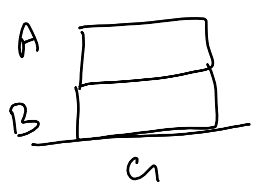












AB-S, BG-S → ✓
AB-S, BG-NS → ✓
AB-NS, BG-S → ✗
AB-NS, BG-NS → ✓

$f \leq \mu_s N$ (not-sliding)
$f = \mu_k N$ (sliding)