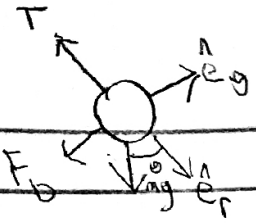
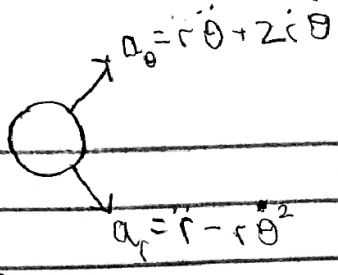
FBD





$\sum F_{e_r} = -T + mgC_\theta = -mr\dot{\theta}^2$
$\sum F_{e_\theta} = -mgS_\theta = mr\ddot{\theta}$ } No drag

$\sum F_{e_r} = -T + mgC_\theta = -mr\dot{\theta}^2$
$\sum F_{e_\theta} = -F_D - mgS_\theta = mr\ddot{\theta}$

$-1.05 \cdot 10^{-3}\dot{\theta}^2 - mg\sin\theta = mr\ddot{\theta}$

Assume $\sin\theta = \theta$

$-1.05 \cdot 10^{-3}\dot{\theta}^2 - mg\theta = mr\ddot{\theta}$

Linearize

$L = f(a) + f'(a)(x-a)$

$f(\theta) = -0.357 + 10.115\theta$

$f(\theta) = -1.05 \cdot 10^{-3}\dot{\theta}^2 - mg\theta$

$-0.357 + 10.115\theta = mr\ddot{\theta}$

$-1.225 + 142.15\theta = \ddot{\theta}$

$L - L\cos\theta$

$L(1-\cos\theta)$

$\frac{1}{2}mv^2 = mgL(1-\cos\theta)$

$v = \sqrt{2gL(1-\cos\theta)}$

$v = 0.157\dot{\theta}$

$\dot{\theta} = \frac{0.157\dot{\theta}}{0.5} \cdot 2\pi = 7.26$

$\ln\frac{x_3}{x_1} = \zeta\omega_n(t_3 - t_1)$

$\frac{\ln(x_2) - \ln(x_1)}{t_2 - t_1} =$