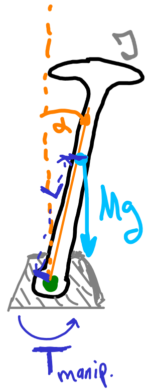


$$J\frac{d^2\alpha}{dt^2} = Mg\cdot L\sin\alpha + T_{manip}$$

$\alpha \simeq 0$

$$s^2\alpha(s) - s\alpha(0) - \alpha'(0)$$

$$J\frac{d^2\alpha}{dt^2} = Mg\cdot L\cdot\alpha + T_{manip}$$

$$(Js^2 - MgL)\cdot\alpha(s) = T_{manip}(s) \quad + J\cdot(s\alpha(0)+\alpha'(0))$$

$$\alpha(s) = \frac{1}{Js^2-MgL}\cdot\left(T_{manip}(s) + Js\alpha(0) + J\alpha'(0)\right)$$

$$\alpha(s) = \frac{1/J}{s^2 - \frac{MgL}{J}}\cdot T_{manip}(s) + \frac{s\alpha(0)+\alpha'(0)}{s^2-\frac{MgL}{J}} \qquad p=\sqrt{\frac{MgL}{J}}$$

$$\alpha(s) = \underbrace{\frac{1/J}{(s+p)(s-p)}}_{T.F.} T_{manip}(s) + \underbrace{\frac{s\alpha(0)+\alpha'(0)}{(s+p)(s-p)}}_{i.c.\ term}$$

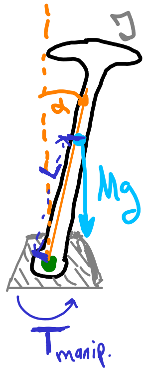
$$\alpha(s) = \frac{2}{(s+1)(s-1)}\cdot T_{manip}(s)$$

Free resp: $(T_{manip}=0)$

$(\alpha(0),\ \alpha'(0)=0)$

$$\alpha(s) = \frac{\alpha(0)\cdot s}{(s+p)(s-p)} = \frac{0.5\alpha(0)}{s+p} + \frac{0.5\alpha(0)}{s-p}$$

$$0.5\alpha(0)\left(e^{-pt} + \underbrace{e^{+pt}}_{\to\infty}\right)$$



Presentation in video: https://personales.upv.es/asala/videos/pendi1.html [Español]

https://personales.upv.es/asala/videos/pendi1EN.html [English]