ME 318 | PRELAB #8 | CEISTIKO, BEN

① $T = \frac{1}{2}\int_0^{\ell} \left(\frac{x^2}{2\ell^3}(3\ell - x)\,\dot{\delta}\right)^2 \rho\,dx$

$T = \frac{1}{2}\dot{\delta}^2 \int_0^{\ell} \frac{x^4(x-3\ell)^2}{4\ell^6}\rho\,dx$

$T = \frac{\dot{\delta}^2\rho}{8\ell^6}\int_0^{\ell} x^4(x-3\ell)^2\,dx$

$T = \frac{\dot{\delta}^2\rho}{8\ell^6}\left(\frac{33\ell^7}{35}\right)$

$T = \dot{\delta}^2\rho\frac{33\ell}{280} = \dot{\delta}^2\left(\frac{99}{280}\right)\left(\frac{\rho\ell}{3}\right)$

$$\boxed{T = \dot{\delta}^2\left(\frac{99}{280}\right)m_{eff}}$$

② $\omega_n = \sqrt{\frac{EI}{mL^3}}\,(L\lambda)^2$

FIND $L\lambda$ VALUES

$\cos(L\lambda) = \frac{-1}{\cosh(L\lambda)}$

SOLVE WITH MATLAB TO GET

$L\lambda = 1.8751,\ 4.6941,\ 7.8548$

$E = 10 \times 10^6$ psi

$m = (0.075\,in)(1.125\,in)(0.1\,\frac{lbm}{in^3}) \times \left(\frac{1\,slug}{32.2\,lbm}\right)$
$(7\,in) = 0.00184$ slug

~~L =~~ 7 in

$I = \frac{1}{12}wh^3 = 0.008894\ in^4$

$\omega_1 = 1320.3 \frac{rad}{s}$

$\omega_2 = 8274.12 \frac{rad}{s}$

$\omega_3 = 23,167.8 \frac{rad}{s}$