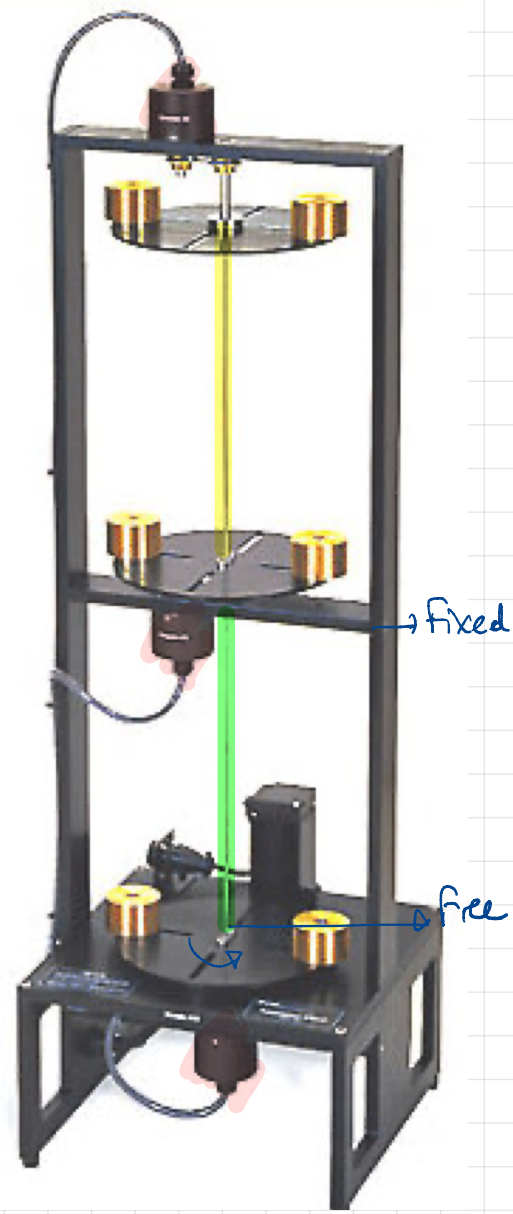
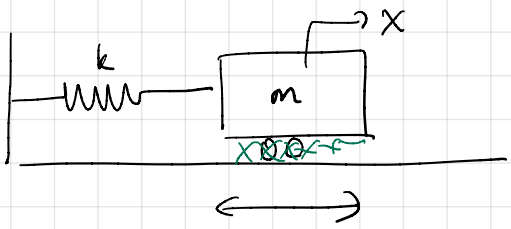
Modeling of SDOF Torsional System



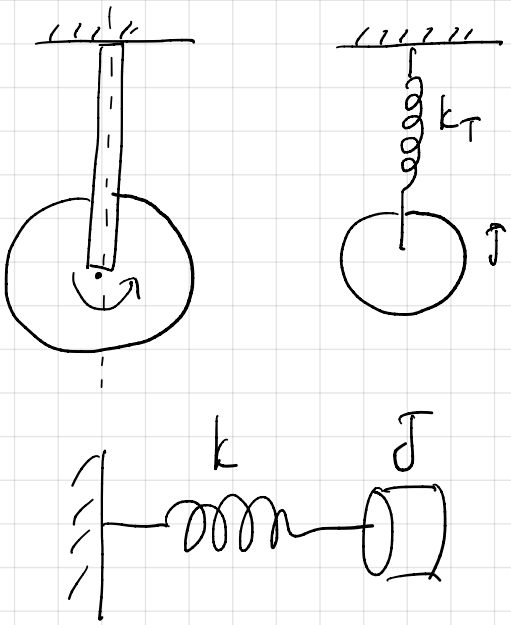


$$\Sigma \vec{F} = m \cdot \ddot{x}$$

$$\downarrow \quad \downarrow$$

$$kg$$

The sketch of SDOF

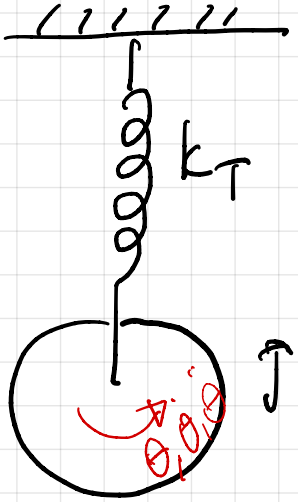


$$\Sigma \vec{M} = J \cdot \ddot{\theta}$$

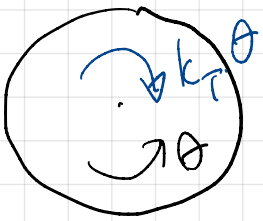
$$\downarrow \quad \downarrow$$

$$kgm^2$$

$$J = \int r^2 dm$$



F.B.D



$$\Sigma \vec{M} = J \cdot \ddot{\theta}$$

$$-k_T\theta = J \cdot \ddot{\theta}$$

$$J\ddot{\theta} + k_T\theta = 0$$

↳ free response

The equation of motion SDOF torsional system

$$J\ddot{\theta} + k_T \theta = 0 \quad (1)$$

$$\ddot{\theta}(t) + \frac{k_T}{J}\cdot\theta(t) = 0$$

$$\ddot{\theta}(t) + \omega_n^2\,\theta(t) = 0$$

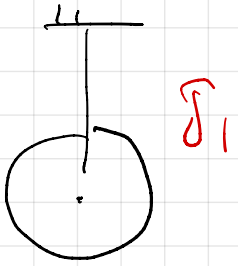
$$\omega_n^2 = \frac{k_T}{J}$$

$$\omega_n = \sqrt{\frac{k_T}{J}} \quad (2)$$

$$\omega_n = 2\pi f_n \Rightarrow f_n = \frac{1}{2\pi}\cdot\omega_n \quad (3)$$

$$f_n = \frac{1}{2\pi}\sqrt{\frac{k_T}{J}} \quad (4)$$

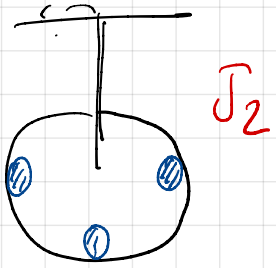
System I



unloaded

$$\omega_n = \sqrt{\frac{k_T}{J}}$$

System II



loaded

→ We collected data from SDOF unloaded disk → accelerometer.

→ We plotted power spectrum in NI Signal Expres.

* Use Eqn. 4 to calculate the inertia of system I.