Bifilar Pendulum

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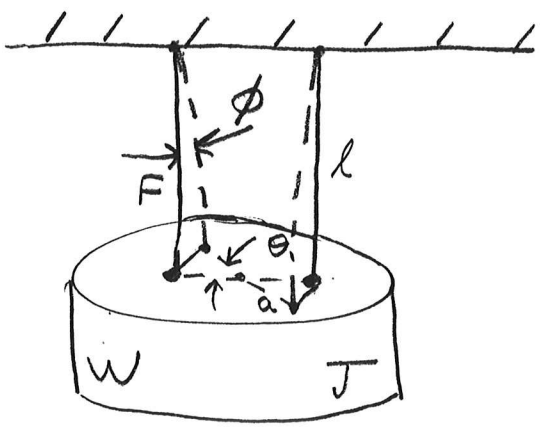

- Twist through small angle.
- Tensile force of ropes will not change; F remains constant
- Neglect damping

$$\sum T = J\ddot{\theta}$$

$-2f(\sin\phi)(a) \rightarrow$ restoring moment

$$-2fa\sin\phi = J\ddot{\theta}$$

$$\ell\phi = a\theta \Rightarrow \phi = \frac{a\theta}{\ell}$$

$$-2fa\sin\left(\frac{a\theta}{\ell}\right) = J\ddot{\theta}$$

$\sin\theta \approx \theta$ small angles

$$-2f\frac{a^2\theta}{\ell} = J\ddot{\theta}$$

$$\ddot{\theta} + \frac{2fa^2}{J\ell}\theta = 0$$

$$f = \frac{1}{2\pi}\sqrt{\frac{2fa^2}{J\ell}}$$

But $f = W/2$

$$f = \frac{1}{2\pi}\sqrt{\frac{Wa^2}{J\ell}}$$