円柱表面の位置 → $\vec{r} = (r\cos\theta,\ r\sin\theta)$, $\dot{\vec{r}} = (-r\sin\theta\cdot\dot{\theta},\ r\cos\theta\cdot\dot{\theta})$

⇓ ある r の位置で固定した

dk_ℓ (微小の運動エネルギー) $= \frac{1}{2}dm(|\dot{\vec{r}}|)^2 = \frac{1}{2}\underbrace{\rho dV}_{\frac{m}{\ell}dr}\cdot\underbrace{\|\dot{\vec{r}}\|^2}_{r\dot{\theta}} = \frac{1}{2}\frac{m}{\ell}(r\dot{\theta})^2 dr$

$$k_\ell = \int_V dk_\ell = \int_0^\ell dr\ \frac{1}{2}\frac{m}{\ell}r^2\dot{\theta}^2 = \frac{m}{6}\ell^2\dot{\theta}^2$$

$\frac{\Theta}{C}$ + (R $\frac{d\Theta}{dm}$ ⇓ 0) $-\frac{1}{2}a^2\omega(t)B_1\sin\omega_1 t = 0$ $\quad\therefore \frac{\Theta}{C} - \frac{1}{2}a^2\omega(t)B_1\sin\omega_1 t = 0$

$$\Theta = \frac{1}{2}Ca^2\omega B_1\sin\omega_1 t$$

$$\left(\frac{1}{3}\lambda a^3\right)\dot{\omega} = -\frac{1}{4}Ca^2\cdot\left(\dot{\omega}B_1\sin\omega_1 t + \omega\cdot\omega_1\cdot B_1\cos\omega_1 t\right)B_1\sin\omega_1 t\ a^2$$

$$\frac{\dot{\omega}}{\omega} = -\underbrace{\left(\frac{1}{3}ka^3 + \frac{1}{4}B_1Ca^4\sin^2\omega_1 t\right)}_{f^{\prime\prime}} \cdot \underbrace{\frac{1}{4}\omega_1 B_1^2 Ca^2\sin\omega_1 t\cos\omega_1 t}_{\frac{1}{2}f^{\prime}}$$

$\ln(\omega)' = -\frac{1}{2}(\ln f)'$

$\ln\omega + \frac{1}{2}\ln f = C = \ln|\omega\cdot\sqrt{f}|$ (C は積分定数)

$$\omega\sqrt{f}\big|_{t=0} = \omega_0\sqrt{\tfrac{1}{3}\lambda a^3}$$

$$\omega = \omega_0\cdot\frac{\sqrt{\frac{1}{3}\lambda a^3}}{\sqrt{f}} = \omega_0\sqrt{\frac{1}{1+\frac{3B_1^2Ca}{8\lambda}\sin\omega_1 t}}$$