(2) 棒系の運動エネ — $\mathbf{r} = (r\cos\theta,\ r\sin\theta)$, $\dot{\mathbf{r}} = (-r\sin\theta\cdot\dot{\theta},\ r\cos\theta\cdot\dot{\theta})$

⇓

あるrの位置で固定した。

$$\underbrace{dK_e}_{\text{微分の運動エネルギー}} = \frac{1}{2}dm(\dot{\mathbf{r}})^2 = \frac{1}{2}\underbrace{\rho dV}_{\frac{m}{l}dr}\cdot\underbrace{\|\dot{\mathbf{r}}\|^2}_{r\dot{\theta}} = \frac{1}{2}\frac{m}{l}(r\dot{\theta})^2 dr$$

$$K_e = \int_V dK_e = \int_0^l dr\,\frac{1}{2}\frac{m}{l}r^2\dot{\theta}^2 = \underline{\frac{m}{6}l^2\dot{\theta}^2}$$

$$\frac{Q}{C} + R\frac{dQ}{dt} - \frac{1}{2}a^2\omega(t)B_1\sin\omega_1 t = 0 \quad \therefore\ \frac{Q}{C} - \frac{1}{2}a^2\omega(t)B_1\sin\omega_1 t = 0$$

$R\frac{dQ}{dt} \to 0$

$$Q = \frac{1}{2}Ca^2\omega B\sin\omega_1 t$$

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

k

$$\frac{\dot{\omega}}{\omega} = -\underbrace{\left(\frac{1}{3}ka^3 + \frac{1}{4}B_1Ca^4\sin^2\omega_1 t\right)}_{f}\cdot\underbrace{\frac{1}{4}\omega_1 B_1^2Ca^2\sin\omega_1 t\cos\omega_1 t}_{\frac{1}{2}f'}$$

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

$$0 = \left(\ln\omega + \frac{1}{2}\ln f\right)' = \{\ln|\omega\cdot\sqrt{f}|\}'$$

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

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