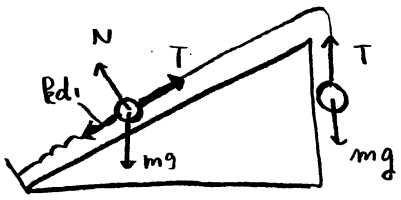
1



(1)

$$T = mg$$

$$\begin{cases} T = kd_1 + mg\sin\theta \\ N = mg\cos\theta \end{cases}$$

連立して.

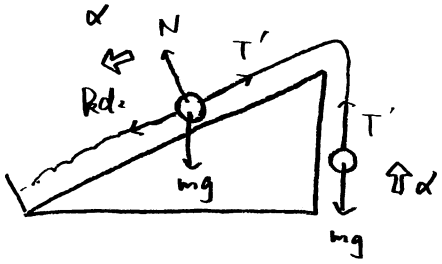
$$mg = kd_1 + mg\sin\theta$$

$$d_1 = \frac{mg(1-\sin\theta)}{k} = \frac{mg}{k}(1-\sin\theta)$$

⑥ ⑤

このとき、弾性エネルギー

$$\frac{1}{2}kd_1^2 \qquad ②$$



(2)

$$m\alpha = T' - mg$$

$$\begin{cases} m\alpha = kd_2 + mg\sin\theta - T' \\ N = mg\cos\theta \end{cases}$$

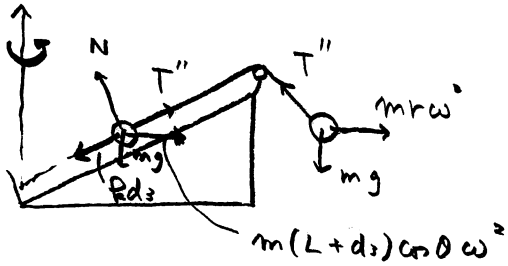
連立して α を消す.

$$T' - mg = kd_2 + mg\sin\theta - T'$$

$$T' = \frac{1}{2}(kd_2 + mg + mg\sin\theta)$$

$$= \frac{1}{2}mg(1+\sin\theta) + \frac{1}{2}kd_2$$

③ ① ②



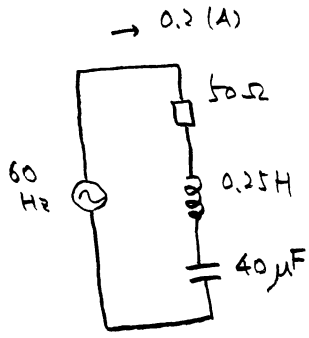
伸びを d_3 とした

$$\begin{cases} T'' = \sqrt{(mg)^2 + (mr\omega^2)^2} \\ T'' + m(L+d_3)\cos\theta\,\omega^2\cos\theta \\ \qquad = kd_3 + mg\sin\theta \end{cases}$$

$$d_3 = \frac{m(L\omega^2\cos^2\theta - g\sin\theta + \sqrt{g^2+r^2\omega^4})}{k - m\omega^2\cos^2\theta}$$

⑦ ⑥ ⑥

2



(1) $\omega = 2\pi f = 2\times 3.14\times 60 = 376.8$ ⑨

$V_R = 0.2\times 50 = 10\ (V)$ ②

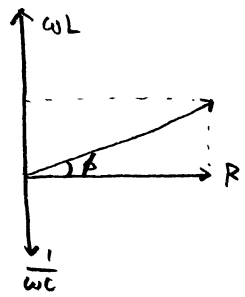
$V_L = \omega L I = 377\times 0.25\times 0.2 = 18.85\ (V)$ ⑥

$V_C = \dfrac{I}{\omega C} = \dfrac{0.2}{377\times 40\times 10^{-6}} = 13.26$ ④

$$Z = \sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2} = \sqrt{50^2 + \left(377\times 0.25 - \frac{1}{377\times 40\times 10^{-6}}\right)^2}$$

$= 57.25$

$V_e = IZ = 0.2\times 57.25 = 11.45 \fallingdotseq 11.5$ ③



$\tan\phi = \dfrac{\omega L - \frac{1}{\omega C}}{R} = 0.558 \fallingdotseq 0.56$ ⑥

$\bar{P} = V_R \times I = 10\times 0.2 = 2\ (W)$ ②

(2)

$\omega L = \dfrac{1}{\omega C}$ となったとき Z は最小となる。このとき

$$\omega = \frac{1}{\sqrt{LC}}, \quad f = \frac{\omega}{2\pi} = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\times 3.14\times\sqrt{0.25\times 40\times 10^{-6}}}$$

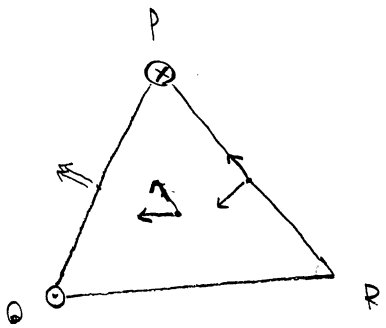
$= 50.3$ ②

$Z = \sqrt{R^2} = 50$

$25 = ZI$ より $I = \dfrac{25}{50} = 0.5\ (A)$ ①

3

(1)



S

$$H_S = \frac{2}{2\pi \times 0.1} \times 2 = 6.36 \quad (7)$$

T

$$H_T = \sqrt{\left(\frac{2}{2\pi \times 0.1}\right)^2 + \left(\frac{2}{2\pi \times 0.1 \times \sqrt{3}}\right)^2}$$

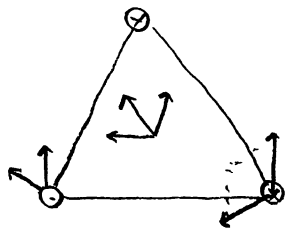
$$= \frac{2}{2\pi \times 0.1 \times \sqrt{3}} \times 2 = 3.67 \quad (3)$$

O

$$H_O = \frac{2}{2\pi \times 0.1 \times \frac{2}{\sqrt{3}}} \times \frac{\sqrt{3}}{2} \times 2 = 4.77 \quad (5)$$

(2)

$$H_O' = \frac{2}{2\pi \times 0.1 \times \frac{2}{\sqrt{3}}} \times 2 = \frac{\sqrt{3}}{0.1\pi} = 5.51 \quad (6)$$

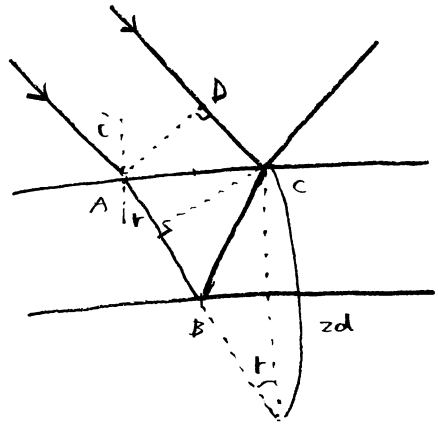


(3)

$$F_Q = \left(4\pi \times 10^{-7} \times \frac{2}{2\pi \times 0.2} \times \frac{\sqrt{3}}{2} \times 2\right) \times 2 \times 1 = 4\sqrt{3} \times 10^{-6} = 6.92 \times 10^{-6} \quad (4)$$

$$F_R = \left(4\pi \times 10^{-7} \times \frac{2}{2\pi \times 0.2}\right) \times 2 \times 1 = 4 \times 10^{-6} \quad (7)$$

④



(1) 右図より.

$\Delta I = 2d\cos r \times n$ ②

$\frac{\sin i}{\sin r} = n$ より $\sin r = \frac{1}{n}\sin i$

$\cos r = \sqrt{1-\sin^2 r} = \sqrt{1-\frac{1}{n^2}\sin^2 i}$

$\Delta I = 2nd\sqrt{1-\frac{1}{n^2}\sin^2 i} = 2d\sqrt{n^2-\sin^2 i}$ ④

(2) Cでの反射の際のみ、位相がずれるので

強のあう条件は $\Delta I = \frac{1}{2}\lambda \times (2m+1) = \frac{2m+1}{2}\lambda$ ⑤

弱のあう条件は $\Delta I = \frac{1}{2}\lambda \times 2m = m\lambda$ ③

(3)

$2\times 1.1\times 10^{-6}\sqrt{1.3^2-\sin^2 30^\circ} = \frac{2m+1}{2}\lambda$

$4.4\times 1.2\times 10^{-6} = 2m\lambda+\lambda$

$\lambda = \frac{5.28\times 10^{-6}}{2m+1}$

$4.0\times 10^{-7} \leqq \frac{5.28\times 10^{-6}}{2m+1} \leqq 8.0\times 10^{-7}$

$4.0\times 10^{-7}(2m+1) \leqq 5.28\times 10^{-6} \leqq 8.0\times 10^{-7}(2m+1)$

$8\times 10^{-7}m \leqq 4.88\times 10^{-6}$, $4.48\times 10^{-6} \leqq 16\times 10^{-7}$

$2.8 \leqq m \leqq 6.1$ 、 $m = 3, 4, 5, 6$

$m=6$ のとき 波長は最も短く $\lambda = \frac{5.28\times 10^{-6}}{13} = 4.06\times 10^{-7}$ ①

$m=3$; 長く $\lambda = \frac{5.28\times 10^{-6}}{7} = 7.54\times 10^{-7}$ ⑦