

# H14 電磁気学演習課題 (2024/7/11)

## 課題 11

(a) 導体 1:  $+Q$  [C] あるとき

$$V'_1 = QP_{11}, V'_2 = QP_{21}$$

導体 2:  $-Q$  [C] あるとき

$$V'_1 = -QP_{12}, V'_2 = -QP_{22}$$

(b)  $V_1 = QP_{11} - QP_{12}$

$$V_2 = QP_{21} - QP_{22}$$

(c)  $V_{12} = V_1 - V_2$

$$= QP_{11} - QP_{12} - (QP_{21} - QP_{22})$$

$$= Q(P_{11} - 2P_{12} + P_{22}) [V]$$

# HI4 電磁氣學 演習課題 (2024/10/1)

## [課題12]

$$(a), (a1) C = \frac{\epsilon_0 S}{d}$$

$$(a2) C = \frac{8.85 \times 10^{-12} \cdot 100 \times 10^{-4}}{5 \times 10^{-3}}$$

$$= 1.77 \times 10^{-11} [F]$$

$$(b) (b1) C = \frac{Q}{V} = 4\pi\epsilon_0 a [F]$$

$$(b2) V = \frac{Q}{4\pi\epsilon_0 a} \text{ 一致だから}$$

$$C = \frac{Q}{\frac{Q}{4\pi\epsilon_0 a}} = 4\pi\epsilon_0 a$$

$$[3.4] C = 4\pi\epsilon_0 a$$

$$= 4 \cdot \pi \cdot 8.85 \times 10^{-12} \cdot 5 \times 10^{-2}$$

$$= 5.56 \times 10^{-12} [F]$$

$$[3.5] C = 4\pi\epsilon_0 a$$

$$= 4\pi \cdot 8.85 \times 10^{-12} \cdot 6370 \times 10^3$$

$$= 7.08 \times 10^{-4} [F]$$

$$(c) (c1) C = \frac{Q}{V} = \frac{4\pi\epsilon_0}{\frac{1}{a} - \frac{1}{b}} [F]$$

$$(c2) (1) a = 10 \text{ cm}, b = 20 \text{ cm}$$

$$C = \frac{4 \cdot \pi \cdot 8.85 \times 10^{-12}}{\frac{1}{10 \times 10^{-2}} - \frac{1}{20 \times 10^{-2}}}$$

$$= 2.22 \times 10^{-11} [F]$$

$$(2) a = 5 \text{ cm}, b = 15 \text{ cm}$$

$$C = \frac{4 \cdot \pi \cdot 8.85 \times 10^{-12}}{\frac{1}{5 \times 10^{-2}} - \frac{1}{15 \times 10^{-2}}}$$

$$= 8.34 \times 10^{-12} [F]$$

# 課題 12) 糸

$$(d) (d1) C = \frac{q}{V} = \frac{2\pi\epsilon_0}{\log \frac{b}{a}} [F/m]$$

$$(d2)(1) a = 10\text{mm}, b = 20\text{mm}$$

$$C = \frac{2\pi \cdot 8.85 \times 10^{-12}}{\log \frac{20 \times 10^{-2}}{10 \times 10^{-2}}} [F/m]$$

$$= 8.02 \times 10^{-11} [F/m]$$

$$(2) a = 5\text{mm}, b = 15\text{mm}$$

$$C = \frac{2\pi \cdot 8.85 \times 10^{-12}}{\log \frac{15 \times 10^{-2}}{5 \times 10^{-2}}} [F/m]$$

$$= 5.06 \times 10^{-11} [F/m]$$

(e)

$$d = 1.2\text{m}$$

$$a = 4\text{mm}$$

$$C = \frac{q}{V} = \frac{\pi\epsilon_0}{\ln \frac{d-a}{a}} [F/m]$$

$$C = \frac{\pi \cdot 8.85 \times 10^{-12}}{\ln \frac{1.2 \times 10^{-2}}{4 \times 10^{-3}}}$$

$$= 4.87 \times 10^{-12} [F/m]$$

$$1\text{km あたり } 4.1 \times 10^{-9} \text{ F}$$

$$C = 4.87 \times 10^{-9} [F/km]$$

$$C = 4.9 [nF/km]$$

$$C = 4.9 [nF/km]$$