電気磁気学

2019 年 3 月 28 日

概要

一関高専電気情報工学科の電気磁気学I，電気磁気学II，電気磁気学IIIの講義をまとめたもの
構成を少し変えてるため，授業の板書と一致しない

1　誘電体（p.）

1.1　誘電体の電極（p.）

1.2　誘電体中の電界（p.）

1.2.1　平行平板コンデンサ（p.）

1.2.2　分極の表し方（p.）

1.2.3　誘電中の電界（p.）

$$\left|\overrightarrow{P}\right| = \sigma_p \left[C/m^2\right] \tag{1.1}$$

$$E_v = \frac{\sigma_t}{\varepsilon_0} \left[v/m\right] \tag{1.2}$$

$$E_d = \frac{\sigma_t - \sigma_p}{\varepsilon_0} \left[V/m\right] \tag{1.3}$$

$$\varepsilon_0 = \frac{E_v}{\sigma_t} \left(\sigma_t - \sigma_p\right) \tag{1.4}$$

$$= \left(1 - \frac{\sigma_p}{\sigma_t}\right) E_v \tag{1.5}$$

$$E_d = \frac{\sigma_t}{\varepsilon_0} - \frac{\sigma_p}{\varepsilon_0} \tag{1.6}$$

$$= E_v - \frac{1}{\varepsilon_0} P \tag{1.7}$$

$$= E^{\rightarrow_v} - \frac{1}{\varepsilon_0} \overrightarrow{P} \tag{1.8}$$

$$C_u = \frac{\varepsilon_0 S}{l} \left[F\right] \tag{1.9}$$

$$C_d = \frac{\varepsilon S}{l} \tag{1.10}$$
$$= \frac{\varepsilon_s \varepsilon_0 S}{l}\,[F] \tag{1.11}$$

$$C_d = \varepsilon_s C_v \tag{1.12}$$

$$\frac{E_d}{E_v} = \frac{V_d/l}{V_v/l} = \frac{V_d}{V_v} \tag{1.13}$$
$$= \frac{Q/Cd}{Q/C_v} = \frac{C_v}{C_d} \tag{1.14}$$

$$\frac{E_d}{E_v} = \frac{C_v}{\varepsilon_s C_v} \tag{1.15}$$
$$E_d = \frac{1}{\varepsilon_s} \cdot E_v \tag{1.16}$$

$$D_v = \varepsilon_0 E_v \tag{1.17}$$

$$D_d = \varepsilon E_d \tag{1.18}$$

$$E_d = \frac{1}{\varepsilon_s} E_v \tag{1.19}$$
$$\varepsilon_s E_d = E_v \tag{1.20}$$
$$\varepsilon_s \varepsilon_0 E_d = \varepsilon_0 E_v \tag{1.21}$$
$$D_d = D_v\,\left[C/m^2\right] \tag{1.22}$$

$$E_v = \frac{\sigma_t}{\varepsilon_0} \tag{1.23}$$
$$\varepsilon_0 E_v = \sigma_t \tag{1.24}$$
$$Dv = \sigma_t\,\left[C/m^2\right] \tag{1.25}$$
$$D_d = \sigma_t\,\left[C/m^2\right] \tag{1.26}$$

$$F = \frac{Q_1 Q_2}{4\pi\varepsilon r^2}\,[N] \tag{1.27}$$

$$W = \frac{1}{2}\varepsilon E^2 \tag{1.28}$$
$$= \frac{1}{2} ED\,\left[J/m^3\right] \tag{1.29}$$

$$f = \frac{1}{2}\varepsilon E^2 \tag{1.30}$$
$$= \frac{1}{2}ED\left[N/m^2\right] \tag{1.31}$$

$$\theta_1 \neq \theta_2 \tag{1.32}$$

$$\oint Edl = 0 \tag{1.33}$$
$$E_{it}\Delta l - E_{2t}\Delta l = 0 \tag{1.34}$$
$$E_{1t} = E_{2t} \tag{1.35}$$

$$H \propto I \tag{1.36}$$
$$B = \mu_0 H \propto I \tag{1.37}$$
$$\phi = BS \propto I \tag{1.38}$$

つまり$\phi \propto I$

$$\psi = n\phi\,[Wb] \tag{1.39}$$

$$\psi \propto I \tag{1.40}$$

$$\psi = LI \tag{1.41}$$

$$n\phi = LI \tag{1.42}$$

$$e = -n\frac{d\phi}{dt} = -\frac{d}{dt}\left(n\phi\right) \tag{1.43}$$
$$= -\frac{d\psi}{dt} \tag{1.44}$$
$$= -L\frac{dI}{dt} \tag{1.45}$$

(1.46)

(1.47)

(1.48)

(1.49)

(1.50)

(1.51)

(1.52)