伯克利 磁学

$$c^2 = \frac{1}{\mu_0 \varepsilon_0}$$

- 安培环路定理

$$\iint \boldsymbol{B} \cdot \mathrm{d}s = \mu_0 I$$
$$\boldsymbol{\nabla} \times \boldsymbol{B} = \mu_0 \boldsymbol{I}$$
$$\boldsymbol{\nabla} \cdot B = 0$$

- 法拉第电磁感应定律

$$\mathscr{E} = -\frac{\mathrm{d}\Phi}{\mathrm{d}t}$$
$$\boldsymbol{\nabla} \times \boldsymbol{E} = -\frac{\partial \boldsymbol{B}}{\partial t}$$

- 能量

$$\begin{aligned} U &= \frac{1}{2} L I^2 = \frac{1}{2} \Psi I = \frac{\Psi^2}{2L} \\ &= \frac{1}{2} C V^2 = \frac{1}{2} Q V = \frac{Q^2}{2C} \\ &= \iiint \frac{1}{2} \mu H^2 \,\mathrm{d}V = \iiint \frac{1}{2} B H \,\mathrm{d}V = \iiint \frac{B^2}{2\mu} \,\mathrm{d}V \\ &= \iiint \frac{1}{2} \varepsilon E^2 \,\mathrm{d}V = \iiint \frac{1}{2} E D \,\mathrm{d}V = \iiint \frac{D^2}{2\varepsilon} \,\mathrm{d}V \end{aligned}$$

- 串联RLC电路 (无电动势) 的环路方程

$$V(t) = \mathrm{e}^{-\alpha t}(A \cos \omega t + B \sin \omega t)$$
$$\alpha = \frac{R}{2L},\ \omega^2 = \frac{1}{LC} - \frac{R^2}{4L^2}$$

- 若加入正弦电动势

$$\mathscr{E}_t = \mathscr{E}_0 \cos \omega t$$
$$I_0 = \frac{\mathscr{E}_0}{\sqrt{R^2 + (\omega L - 1/\omega C)^2}}$$
$$\tan \phi = \frac{1}{R \omega C} - \frac{\omega L}{R}$$

- 麦克斯韦方程组

$$\nabla \times \boldsymbol{E} = -\frac{\partial \boldsymbol{B}}{\partial t}$$
$$\nabla \times \boldsymbol{H} = \boldsymbol{J} + \varepsilon_0 \frac{\partial \boldsymbol{E}}{\partial t} = \boldsymbol{J} + \frac{\partial \boldsymbol{D}}{\partial t}$$
$$\nabla \cdot \boldsymbol{E} = \frac{\rho}{\varepsilon_0}$$
$$\nabla \cdot \boldsymbol{B} = 0$$

- 计算电动势

$$\text{动生电动势：} \quad \mathscr{E} = \int \boldsymbol{v} \times \boldsymbol{B} \cdot \mathrm{d}\boldsymbol{l}$$

- 电荷与电流受力

$$\boldsymbol{F} = q\boldsymbol{v} \times \boldsymbol{B}$$