אלקטרוסטטיקה

משוואות הבסיס

$$\vec{F} = \frac{Qq}{r^2}\hat{r} \qquad \phi = -\int_{\infty}^{r} E \cdot dr$$

$$\vec{E} = \frac{Q}{r^2}\hat{r} \qquad -\nabla\phi_{(r)} = -\frac{d}{dr}(\phi) = \vec{E}_{(r)}$$

$$U = \int_0^{\infty} E_{(r)}^2 \cdot dv = Q\phi = Q^2\frac{1}{C} = \phi^2 C$$

$$\rho \to \vec{E} \quad \vec{E}_{(r)} = \frac{1}{r^j}\int r^j \cdot \rho_{(r)} \cdot dr$$

$$\vec{E} \to \rho \quad \rho_{(r)} = \frac{1}{r^j}\frac{d(r^j \cdot \vec{E}_{(r)})}{dr} = \vec{\nabla} \cdot \vec{E}_{(r)}$$

$$\Delta E = \sigma \qquad \sigma \cdot R^2 = Q_{tot}$$

$$C_{par} = \Sigma C_i = \int dC \quad C_{sphere} = R \quad C = \frac{Q}{V}$$

$$\frac{1}{C_{ser}} = \Sigma\frac{1}{C_i} = \int\frac{1}{dC} \quad C_{peel} = \frac{R^2}{\Delta} = C_{surface}$$

$$E_{new} = \frac{1}{\epsilon}E_{old} \quad \phi_{new} = \frac{1}{\epsilon_{(r)}}\phi_{old} \quad C_{new} = \epsilon_{(r)} \cdot C_{old}$$

$$\lambda = \sigma \cdot 2\pi R = \rho \cdot \pi R^2$$

	$sphere$	$cylinder$	$surface$
$\vec{E}_{(r)}$	$\frac{Q}{r^2}, \frac{Q}{R^3}r$	$\frac{\lambda}{r}, \lambda r$	σ
$V_{(r)}$	$\frac{Q}{r}$	$\lambda \cdot lan(r)$	$\sigma \cdot y$

$$\vec{E}_{(z,R)}\hat{z} = Q\frac{z}{(z^2+R^2)^{\frac{3}{2}}}\hat{z} \quad ring \quad \vec{E}_{(z,R)}\hat{z} = \frac{Q}{R^2}\cdot\left(1 - \frac{z}{\sqrt{z^2+R^2}}\right) \quad disk \quad \Phi_E = \oint_S \vec{E} \cdot ds = Q_{in} \quad Gauss's\ law$$

אלקטרוסטטיקה בקואורדינטות שונות	$sphere$	$cylinder$	$plane$
$\Sigma\vec{E}_{(r)}$	$\frac{Q}{r^2}, \frac{VR}{r^2}$	$\frac{\lambda}{\rho}, \frac{1}{lan(\frac{b}{a})}\frac{V}{\rho}$	$\sigma, \frac{V}{h}$
$\phi_{(r)}$	$\frac{Q}{r}+$	$\lambda \cdot lan(\rho)+$	$\sigma \cdot y+$
$(\epsilon_r) \cdot C$	$\frac{R^2}{d}$	$\frac{l}{lan\frac{b}{a}}$	$\frac{S}{d}$
$\vec{\nabla} \cdot \vec{E}_{(r)}$	$\frac{1}{r^2}\frac{d}{dr}(r^2E)$	$\frac{1}{r}\frac{d}{dr}(rE)$	$\frac{d}{dr}(E)$

$\boldsymbol{C=\frac{Q}{V}}$ $\boldsymbol{C_{plane}=\frac{S}{H}}$ $\boldsymbol{1<\epsilon<\infty}$ $\Delta E=\sigma=\frac{Q_0}{S}\frac{1}{\epsilon}=\frac{Q_0}{S}-\frac{Q_0}{S}(1-\frac{1}{\epsilon})$

אלקטרוסטטיקה קבל כדורי עם דיאלקט	$Q_0,\epsilon_{(\not r)}$	$V_0,\epsilon_{(\not r)}$	$Q_0,\epsilon_{(r)}$	$V_0,\epsilon_{(r)}$
$-\nabla\phi_{(r)}=\vec{E}_{(r)}$	$\frac{Q_0}{S}\frac{1}{\epsilon}$	$\frac{V_0}{H}\frac{1}{\epsilon}$	$\frac{Q_0}{S}\frac{1}{\epsilon_{(r)}}$	$\frac{CV_0}{S}\frac{1}{\epsilon_{(r)}}$
$-\int\vec{E}\cdot d\vec{l}=\phi_{(r)}$	$\frac{Q_0}{S}y\frac{1}{\epsilon}$	$\frac{V_0}{H}y\frac{1}{\epsilon}$	$\frac{Q_0}{S}\int\frac{1}{\epsilon_{(r)}}$	$\frac{CV_0}{S}\int\frac{1}{\epsilon_{(r)}}$
$Q_0(free-[bound)]$ Q	$Q_0(1-[1-\frac{1}{\epsilon})]$	$\frac{V_0}{H}S\epsilon(1-[1-\frac{1}{\epsilon})]$	$Q_0(1-[1-\frac{1}{\epsilon_{(r=o)}})]$	$CV_0(1-[1-\frac{1}{\epsilon_{(r=0)}})]$
C	$\frac{S}{H}\epsilon$	$\frac{S}{H}\epsilon$	$\frac{S}{H}\int\epsilon_{(r)}$	$\frac{S}{H}\int\epsilon_{(r)}$

אלקטרודינמיקה

$$I = \frac{dQ}{dt} \qquad VI = V\frac{dQ}{dt} = P_{[watt]}$$

$$\frac{V}{R} = I$$

$$\rho_{_R} = \frac{1}{\sigma_{_R}}$$

$$\frac{E}{\rho_{_R}} = J$$

$$series \Rightarrow R_{tot} = \Sigma R_i = \int dR$$

$$parallel \Rightarrow \frac{1}{R_{tot}} = \Sigma\frac{1}{R_i} = \int\frac{1}{dR}$$

$$\vec{J} = \frac{\vec{I}}{ds}, \int \vec{J}\cdot ds = \vec{I}$$

$$\vec{K} = \frac{\vec{I}}{dl}, \int \vec{K}\cdot dl = \vec{I}$$

מגנטיות

נוסחאות ראשונות

$$\Phi_B = \oint B \cdot ds$$

$$\epsilon = -\dot{\Phi}_{B \ (Lenz's\ law)}$$

$$\underline{\dot{B}\neq 0\ ,\ \ \dot{S}\neq 0\ ,\ \ \dot{\theta}\neq 0} \Rightarrow \dot{\Phi}_B$$

$$\vec{B}_{(r)\hat{\theta}} = (I + \dot{E}) \cdot \frac{1}{r}$$

$$L = \frac{\Phi}{I} \qquad M = \frac{\Phi_1}{I_2} = \frac{\Phi_2}{I_1}$$

$$\vec{\mu} = IS\hat{n}$$

$$\vec{\tau} = \vec{\mu} \times \vec{B}$$

$$\vec{\nabla} \times \vec{E} = (\frac{1}{r}\frac{\partial E_{\hat{z}}}{\partial \theta} - \frac{\partial E_{\hat{\theta}}}{\partial z})\hat{r}$$

$$\vec{\nabla} \times \vec{E} = -\frac{\partial B}{\partial t} \quad (\frac{\partial E_{\hat{r}}}{\partial z} - \frac{\partial E_{\hat{z}}}{\partial r})\hat{\theta}$$

$$\frac{1}{r}[\frac{\partial (rE_{\hat{\theta}})}{\partial r} - \frac{\partial E_{\hat{r}}}{\partial \theta}]\hat{z}$$

מגנטיות

שדות במצבים מיוחדים

$$amper \quad \oint B \cdot dl = I_{in}$$

$$d\vec{B}_{BioSavar} = \frac{I}{r^2}(d\vec{l} \times \hat{r})$$

$$\vec{F}_{lorentz} = q\vec{V} \times \vec{B}$$

$$\vec{F}_{BIL} = (\vec{I} \times \vec{B})L = \lambda(\vec{v} \times \vec{B})L$$

$$\vec{B}_{(r)\hat{\theta}} = I\frac{1}{r}$$

$$\vec{B}_{(0,R)\hat{z}} = \frac{I}{R}\hat{z}$$

$$\vec{B}_{(r)\hat{\theta}} = \frac{I}{R^2}r$$

$$\vec{B}_{(z,R)\hat{z}} = I\frac{R^2}{(z^2+R^2)^{\frac{3}{2}}}\hat{z}$$

$$\vec{B}_{(n)\hat{z}} = n \cdot I$$

$$\vec{B}_{(z,R)\hat{z}} = \frac{q \cdot \omega}{\pi R^2}[\frac{R^2+2Z^2}{(R^2+Z^2)^{\frac{3}{2}}} - 2z]$$

$$\vec{B}_{(y)\hat{x}} = \pm\vec{K}_{\hat{z}}$$

$$\vec{I} = \frac{dQ}{dt} = Q \cdot \vec{v} = \lambda \cdot \vec{v} = Q_{ring} \cdot \vec{\omega}$$