ELEKTROSTATİK

$\vec{E}=\frac{\rho_l}{2\pi\varepsilon_0 r}\vec{a}_r$, $\vec{E}=\frac{\rho_S}{2\varepsilon_0}\vec{a}_R$	$\vec{E}=Q\vec{E}$, $W=-\int\vec{F}\,d\vec{l}$, $W=-\int Q\vec{E}\,d\vec{l}$	$W_E=\frac{1}{2}\int\varepsilon E^2 dv$
$I=\int\vec{J}\,d\vec{s}$, $\vec{J}=\sigma\vec{E}$	$\oint_s\vec{D}\cdot d\vec{s}=Q_{enc}$, $\vec{D}=\varepsilon\vec{E}$, $\vec{F}=q\vec{E}$	$Q=\int_s\rho_s ds\,Q=\int\rho_l\,d\vec{l}$, $Q=\int_v\rho_v\,dV$ [C]
$\mathbf{D}=\frac{Q}{4\pi r^2}\mathbf{a}_r$, $\mathbf{D}=\frac{d\Psi}{dS}\mathbf{a}$	$P(x,y,z)$, $P(r,\phi,z)$, $P(r,\theta,\phi)$	$\nabla\cdot\vec{D}=\rho$, $\text{div}\,\vec{E}=\frac{\rho}{\varepsilon_0}$, $\vec{D}=\frac{d\psi}{ds}$
$\mathbf{F}=Q\mathbf{E}$, $\mathbf{F}_e=-Q\mathbf{E}$	$R=\frac{\ell}{\sigma A}$ (Ω), $R=\frac{V}{\int\mathbf{J}\cdot d\mathbf{S}}=\frac{V}{\int\sigma\mathbf{E}\cdot d\mathbf{S}}$	$W=\frac{1}{2}QV=\frac{1}{2}\left(\frac{\epsilon AV^2}{d}\right)=\frac{1}{2}CV^2$

$d\vec{l}=dx\,\vec{a}_x+dy\,\vec{a}_y+dz\,\vec{a}_z$ (kartezyen)

$d\vec{l}=d\rho\,\vec{a}_\rho+\rho\,d\phi\,\vec{a}_\phi+dz\,\vec{a}_z$ (silindirik)

$d\vec{l}=dr\,\vec{a}_r+r\,d\theta\,\vec{a}_\theta+r\sin(\theta)\,d\phi\,\vec{a}_\phi$ (küresel)

$V_{AB}=\frac{W}{Q_B}=-\int_B^A\vec{E}\,d\vec{l}$

$V_{AB}=\frac{Q}{4\pi\epsilon_0}\left(\frac{1}{r_A}-\frac{1}{r_B}\right)$

$$\nabla V=\frac{\partial V}{\partial x}\vec{a}_x+\frac{\partial V}{\partial y}\vec{a}_y+\frac{\partial V}{\partial z}\vec{a}_z$$

$$\nabla V=\frac{\partial V}{\partial \rho}\vec{a}_\rho+\frac{1}{\rho}\frac{\partial V}{\partial \phi}\vec{a}_\phi+\frac{\partial V}{\partial z}\vec{a}_z$$

$\vec{E}=-\nabla V$, $\oint\mathbf{D}\cdot d\mathbf{S}=\int(\nabla\cdot\mathbf{D})\,dv$

$\mu_0=4\pi 10^{-7}$ H/m, $\varepsilon_r=\frac{\varepsilon}{\varepsilon_0}$

$\varepsilon_0=8{,}854.10^{-12}$ F/m, $\mu_r=\frac{\mu}{\mu_0}$

$$\nabla V=\frac{\partial V}{\partial r}\vec{a}_r+\frac{1}{r}\frac{\partial V}{\partial \theta}\vec{a}_\theta+\frac{1}{r\sin\theta}\frac{\partial V}{\partial \phi}\vec{a}_\phi$$

	Kartezyen Koordinatlar (x,y,z) $-\infty < x,y,z < +\infty$	Silindirik Koordinatlar (ρ,ϕ,z) $0\le\rho<\infty; 0\le\phi<2\pi; -\infty<z<\infty$	Küresel Koordinatlar (r,θ,ϕ) $0\le R<+\infty; 0\le\theta\le\pi; 0\le\phi<2\pi$
Diferansiyel Hacim, dV	$dxdydz$	$\rho d\rho d\phi dz$	$r^2\sin\theta\,d\theta d\phi dr$
Diferansiyel Alan, dS	$dydz$ $dxdz$ $dxdy$	$\rho d\phi dz$ $d\rho dz$ $\rho d\rho d\phi$	$r^2\sin\theta\,d\theta d\phi$ $r\sin\theta\,d\phi dr$ $rd\theta dr$
Diferansiyel Uzunluk, $d\ell$	dx dy dz	$d\rho$ $\rho d\phi$ dz	dr $rd\theta$ $r\sin\theta\,d\phi$

$C_1=\frac{\epsilon_0\epsilon_{r1}A_1}{d}$ $\qquad C_2=\frac{\epsilon_0\epsilon_{r2}A_2}{d}$

$C_{eq}=C_1+C_2=\frac{\epsilon_0}{d}(\epsilon_{r1}A_1+\epsilon_{r2}A_2)$

$C_1=\frac{\epsilon_0\epsilon_{r1}A}{d_1}$ $\qquad C_2=\frac{\epsilon_0\epsilon_{r2}A}{d_2}$

$\frac{1}{C_{eq}}=\frac{1}{C_1}+\frac{1}{C_2}=\frac{\epsilon_{r2}d_1+\epsilon_{r1}d_2}{\epsilon_0\epsilon_{r1}\epsilon_{r2}A}$

$$\nabla\cdot\vec{A}=\frac{\partial A_x}{\partial x}+\frac{\partial A_y}{\partial y}+\frac{\partial A_z}{\partial z}$$

$$\nabla\cdot\vec{A}=\frac{1}{r}\frac{\partial(rA_r)}{\partial r}+\frac{1}{r}\frac{\partial A_\phi}{\partial\phi}+\frac{\partial A_z}{\partial z}$$

$$\nabla\cdot\vec{A}=\frac{1}{r^2}\frac{\partial(r^2A_r)}{\partial r}+\frac{1}{r\sin\theta}\frac{\partial(A_\theta\sin\theta)}{\partial\theta}+\frac{1}{r\sin\theta}\frac{\partial(A_\varphi)}{\partial\varphi}$$

$$W_E=\frac{1}{2}\int\rho V\,dV=\frac{1}{2}\int\vec{D}\vec{E}\,dV=\frac{1}{2}\int\epsilon\vec{E}\,dV=\frac{1}{2}\int\frac{D^2}{\epsilon}dV$$

$\vec{F}=\frac{Q_1Q_2}{4\pi\varepsilon_0 R^2}\vec{a}_R$, $\vec{E}=\frac{Q}{4\pi\varepsilon_0 R^2}\vec{a}_R$, $V=\frac{Q}{4\pi\varepsilon_0 R}$

$\vec{E}=\frac{1}{4\pi\varepsilon_0}\int_\ell\frac{\rho_\ell d\ell}{R^2}\vec{a}_R$, $\vec{E}=\frac{1}{4\pi\varepsilon_0}\int_s\frac{\rho_s ds}{R^2}\vec{a}_R$, $\vec{E}=\frac{1}{4\pi\varepsilon_0}\int_v\frac{\rho_v dv}{R^2}\vec{a}_R$

$V=\frac{1}{4\pi\varepsilon_0}\int_\ell\frac{\rho_\ell d\ell}{R}$, $V=\frac{1}{4\pi\varepsilon_0}\int_S\frac{\rho_S ds}{R}$, $V=\frac{1}{4\pi\varepsilon_0}\int_v\frac{\rho_v dv}{R}$

$\mathbf{D}=\epsilon_0\mathbf{E}+\mathbf{P}$, $\mathbf{P}=\chi_e\epsilon_0\mathbf{E}$

$\mathbf{D}=\epsilon_0(1+\chi_e)\mathbf{E}=\epsilon_0\epsilon_r\mathbf{E}$

$C=Q/V=\epsilon_o\epsilon_r A/d$

$\mathbf{A}\cdot\mathbf{B}=A_xB_x+A_yB_y+A_zB_z$

$$\mathbf{A}\times\mathbf{B}=\begin{vmatrix}\mathbf{a}_x & \mathbf{a}_y & \mathbf{a}_z\\ A_x & A_y & A_z\\ B_x & B_y & B_z\end{vmatrix}$$

MANYETİK

$\vec{H} = \int \frac{I\, \vec{d\ell} \times \vec{a}_R}{4\pi R^2}$

$L = \frac{N\phi}{I}$

$\vec{H} = \frac{I}{2\pi r}\vec{a}_\phi \; [A/m]$

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

$\vec{J} = \rho \vec{U} = \sigma \vec{E}$

$\oint \vec{H}\, \vec{dl} = I_{iç}$

$W = \frac{1}{2} C V^2$

$\nabla \times \vec{H} = \vec{J}$

$\vec{B} = \mu_0 \vec{H} \; [T]$

$\phi = \int_S \vec{B}\, \vec{ds}$

$\nabla \times \vec{A} = \vec{B}$

$\vec{A} = \oint \frac{\mu I \vec{dl}}{4\pi R}$

$\vec{F} = \rho \vec{U} \times \vec{B}$

$\vec{F} = \rho(\vec{E} + \vec{U} \times \vec{B})$

$\vec{F} = \int I(\vec{dl} \times \vec{B})$

$L = \frac{N\phi}{I}$

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

$\vec{J} = \rho \vec{U} = \sigma \vec{E}$

$\vec{B} = \frac{\mu_o I}{2\pi\rho}\vec{a}\phi$, $\Phi = \int_s \vec{B}.\vec{ds}$, $\vec{F} = I\vec{L} \times \vec{B}$, $\vec{B} = \nabla \times \vec{A}$

$H_a \ell_a = \frac{\phi}{\mu_o S_a}\ell_a$, $S_a = (a+\ell_a)(b+\ell_a)$, $\Phi = \int_s \vec{B}.\vec{ds}$ $\vec{A} = \frac{\mu}{4\pi}\int_l \frac{I\vec{dl}}{r}$

$\vec{B} = \frac{\mu_0 I}{4\pi\rho}\left[\frac{b}{\sqrt{\rho^2+b^2}} - \frac{a}{\sqrt{\rho^2+a^2}}\right]\vec{a}_\phi$, $\vec{B} = \frac{\mu_0 I b^2}{2(b^2+z^2)^{3/2}}\vec{a}_z$

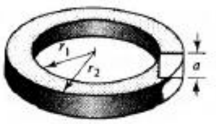
$$\nabla \times \vec{A} = \left(\frac{\partial A_z}{\partial y} - \frac{\partial A_y}{\partial z}\right)\vec{a}_x + \left(\frac{\partial A_x}{\partial z} - \frac{\partial A_z}{\partial x}\right)\vec{a}_y + \left(\frac{\partial A_y}{\partial x} - \frac{\partial A_x}{\partial y}\right)\vec{a}_z$$

$$\nabla \times \vec{A} = \left(\frac{1}{r}\frac{\partial A_z}{\partial \phi} - \frac{\partial A_\phi}{\partial z}\right)\vec{a}_r + \left(\frac{\partial A_r}{\partial z} - \frac{\partial A_z}{\partial r}\right)\vec{a}_\phi + \frac{1}{r}\left(\frac{\partial (rA_\phi)}{\partial r} - \frac{\partial A_r}{\partial \phi}\right)\vec{a}_z$$

$$\nabla \times \vec{A} = \frac{1}{r\sin\theta}\left(\frac{\partial (A_\phi \sin\theta)}{\partial \theta} - \frac{\partial A_\theta}{\partial \phi}\right)\vec{a}_r + \frac{1}{r}\left(\frac{1}{\sin\theta}\frac{\partial A_r}{\partial \phi} - \frac{\partial (rA_\phi)}{\partial r}\right)\vec{a}_\theta + \frac{1}{r}\left(\frac{\partial (rA_\theta)}{\partial r} - \frac{\partial A_r}{\partial \theta}\right)\vec{a}_\phi$$

$\oint_l \vec{H}.\vec{dl} = I$, $\nabla \times \vec{H} = \vec{J}$, $\Phi = \oint_l \vec{A}.\vec{dl}$, ,

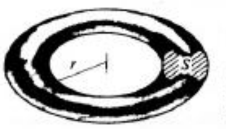
$$\nabla \times \vec{B} = \begin{vmatrix} \vec{a}_x & \vec{a}_y & \vec{a}_z \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ B_x & B_y & B_z \end{vmatrix}$$



$L = \frac{\mu_0 N^2 a}{2\pi}\ln\frac{r_2}{r_1}$ (H)

N sarımlı

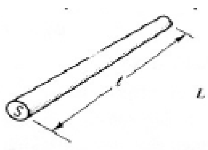
Şekil 11-3 Toroid, kare kesitli



$L = \frac{\mu_0 N^2 S}{2\pi r}$ (H)

(ortalama r yarıçapında ortalama akı yoğunluğu varsayılmıştır)

Şekil 11-4 Toroid, genel S kesitli



$L = \frac{\mu_0 N^2 S}{\ell}$ (H)

Şekil 11-7 Küçük S kesit alanlı uzun solenoit

$i_D = \int_S \mathbf{J}_D \cdot d\mathbf{S} = \int_S \frac{\partial \mathbf{D}}{\partial t}\cdot d\mathbf{S} = \frac{d}{dt}\int_S \mathbf{D}\cdot d\mathbf{S}$

$\mathbf{J}_t = \mathbf{J}_c + \mathbf{J}_D = \sigma\mathbf{E}$ ·

$v_{ab} = \int_b^a \mathbf{E}_m \cdot d\mathbf{l} = \int_b^a (\mathbf{U}\times\mathbf{B})\cdot d\mathbf{l}$

$\oint_C \mathbf{E}\cdot d\mathbf{l} = -\frac{d}{dt}\int_S \mathbf{B}\cdot d\mathbf{S}$

$\nabla \times \mathbf{H} = \frac{\partial \mathbf{D}}{\partial t}$	$\oint \mathbf{H}\cdot d\mathbf{l} = \int_s \left(\frac{\partial \mathbf{D}}{\partial t}\right)\cdot d\mathbf{S}$
$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$	$\oint \mathbf{E}\cdot d\mathbf{l} = \int_s \left(-\frac{\partial \mathbf{B}}{\partial t}\right)\cdot d\mathbf{S}$
$\nabla \cdot \mathbf{D} = 0$	$\oint_S \mathbf{D}\cdot d\mathbf{S} = 0$
$\nabla \cdot \mathbf{B} = 0$	$\oint_S \mathbf{B}\cdot d\mathbf{S} = 0$