Maxwell's Equations

Name	Differential Form	Integral Form
Gauss' Law	$\nabla\cdot\mathbf{E}=\frac{\rho}{\varepsilon_0}$	$\Phi_\mathbf{E}=\int_S\mathbf{E}\cdot d\mathbf{S}=\frac{Q_{enc}}{\varepsilon_0}$
Faraday's Law of Induction	$\nabla\times\mathbf{E}=-\frac{\partial\mathbf{B}}{\partial t}$	$\mathcal{E}=\oint_C\mathbf{E}\cdot d\mathbf{l}=-\frac{d}{dt}\int_S\mathbf{B}\cdot d\mathbf{S}=-\frac{d\Phi_\mathbf{B}}{dt}$
Gauss' Law for Magnetism	$\nabla\cdot\mathbf{B}=0$	$\Phi_\mathbf{B}=\int_S\mathbf{B}\cdot d\mathbf{S}=0$
Ampere's Law	$\nabla\times\mathbf{B}=\mu_0\mathbf{J}+\mu_0\varepsilon_0\frac{\partial\mathbf{E}}{\partial t}$	$\oint_C\mathbf{B}\cdot d\mathbf{l}=\mu_0I_{enc}+\mu_0\varepsilon_0\frac{d\Phi_\mathbf{E}}{dt}$

Energy and Force

$u=\frac{1}{2}\varepsilon_0\mathbf{E}^2=\frac{1}{2\mu_0}\mathbf{B}^2$	$U=\frac{1}{2}CV^2=\frac{1}{2}Li^2=\frac{1}{2}\int_\tau\rho\phi d\tau=\frac{q_1q_2}{4\pi\varepsilon_0 r}=-\mathbf{m}\cdot\mathbf{B}=-\mathbf{p}\cdot\mathbf{E}=\int Pdt$
$\tau=\mathbf{m}\times\mathbf{B}=\mathbf{p}\times\mathbf{E}$	$F=-q\mathbf{E}+q\mathbf{v}\times\mathbf{B}=I\mathbf{L}\times\mathbf{B}=\int_\tau\mathbf{J}\times\mathbf{B}d\tau$

Miscellaneous

$P=IV=I^2R=\frac{V^2}{R}$	$\mathbf{E}=-\nabla\phi$	$\mathbf{m}=IA\hat{\mathbf{n}}=I\int d\mathbf{A}$	$I=\frac{dq}{dt}$	$C=\frac{A\varepsilon_0}{d}$
$\frac{1}{\sigma}=\rho=\frac{RA}{l}=\frac{E}{J}$	$\phi=-\oint_C\mathbf{E}d\mathbf{l}$	$W=q_t\int_\infty^r\mathbf{E}dr$	$\nabla\cdot\mathbf{J}+\frac{d\rho}{dt}=0$	$2\pi f=\omega$

Field Formulae

Electric		Magnetic	
Infinite Wire	$\frac{\lambda}{2\pi r\varepsilon_0}$	Infinite Wire	$\frac{\mu_0 I}{2\pi r}$
Finite Wire	$\left.\frac{\lambda x}{4\pi\varepsilon_0 y\sqrt{y^2+x^2}}\right\|_{x_1}^{x_2}$	Finite Wire	$\frac{\mu_0 I}{4\pi r}\int_{\theta_1}^{\theta_2}\cos\phi d\phi$
Infinite Sheet	$\frac{\sigma}{2\varepsilon_0}$	Ring	$\frac{\mu_0 Ir^2}{2(z^2+r^2)^{\frac{3}{2}}}$
Point Charge	$\frac{Q}{4\pi\varepsilon_0 r^2}\hat{\mathbf{r}}$	Biot-Savart	$d\mathbf{B}=\frac{\mu_0 Id\mathbf{l}\times\hat{\mathbf{r}}}{4\pi r^2}$
Hemisphere	$\frac{Q}{8\pi r^2\varepsilon_0}$	Solenoid	$\mu_0 nI$
Ring	$\frac{Qz}{2\pi\varepsilon_0(r^2+z^2)^{\frac{3}{2}}}$		

AC Circuits

$\mathcal{E}=\mathcal{E}_0\sin(\omega t)$	$i=i_0\sin(\omega t+\phi)$	$z=\sqrt{R^2+\left(\omega L-\frac{1}{\omega C}\right)^2}$

Inductors and Transformers

$\mathcal{E}=-\mu_0 n_1N_2A_1\frac{di}{dt}$		$R_{eff}=R_s\left(\frac{\mathcal{E}_p^2}{\mathcal{E}_s^2}\right)=R_s\left(\frac{N_p}{N_s}\right)$
$\mathcal{E}_p=-N_p\frac{d\Phi}{dt}$	$\frac{\mathcal{E}_p}{\mathcal{E}_s}=\frac{N_p}{N_s}$	$P_s=P_p=i_p\mathcal{E}_p=i_s\mathcal{E}_s=\frac{\mathcal{E}_s^2}{R_s}$

Circuits

$i=\frac{V}{R}\left(1-e^{-\frac{tR}{L}}\right)$	$i=\frac{V}{R}e^{-\frac{t}{RC}}$	$Q=CV$	$V=IR$