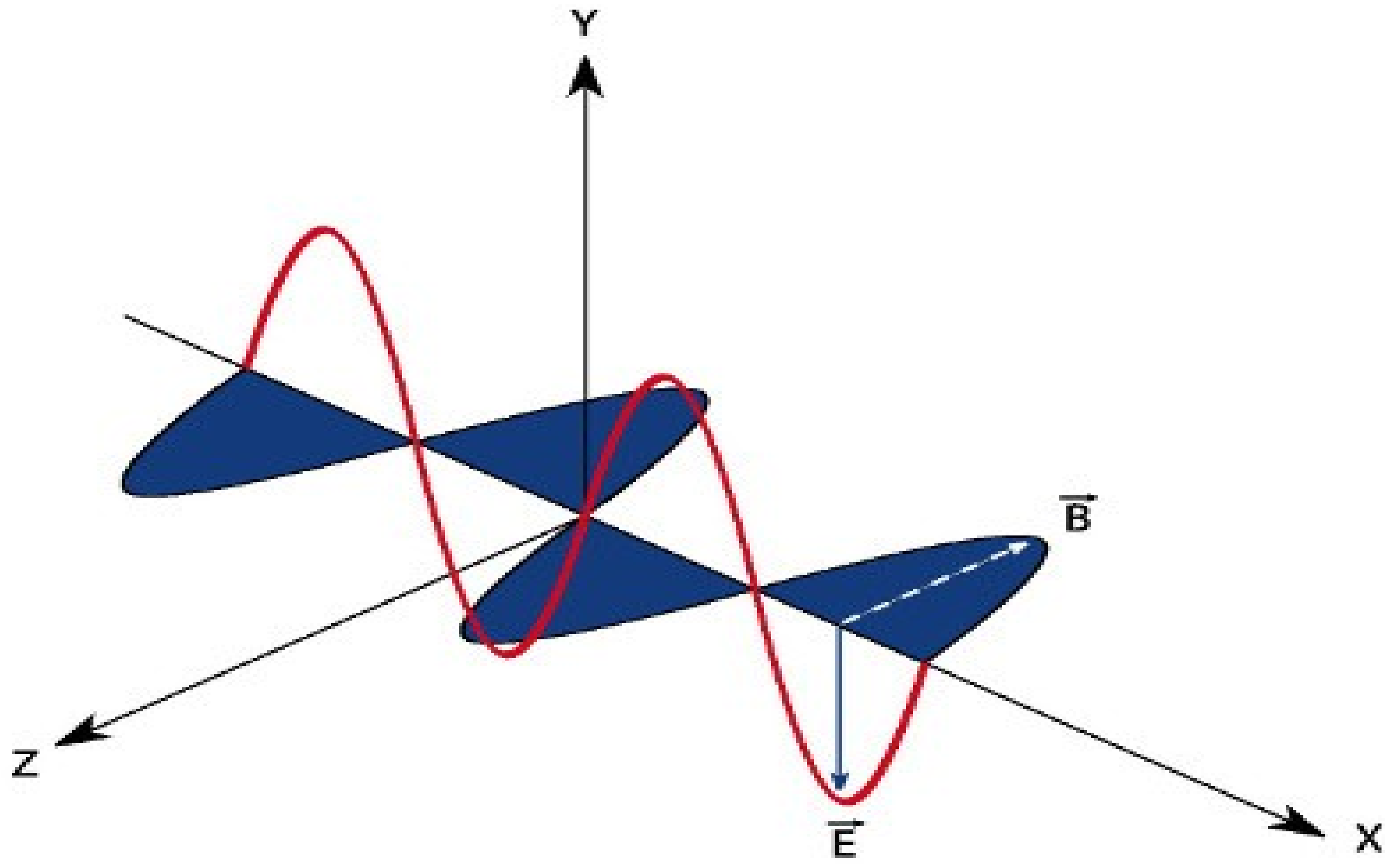
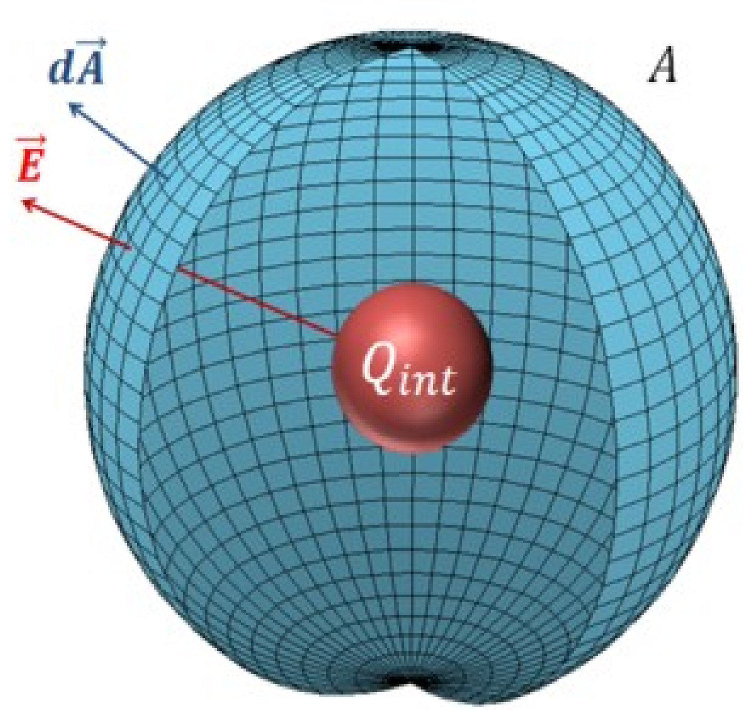
Ondas Eletromagnéticas



As Equações de Maxwell

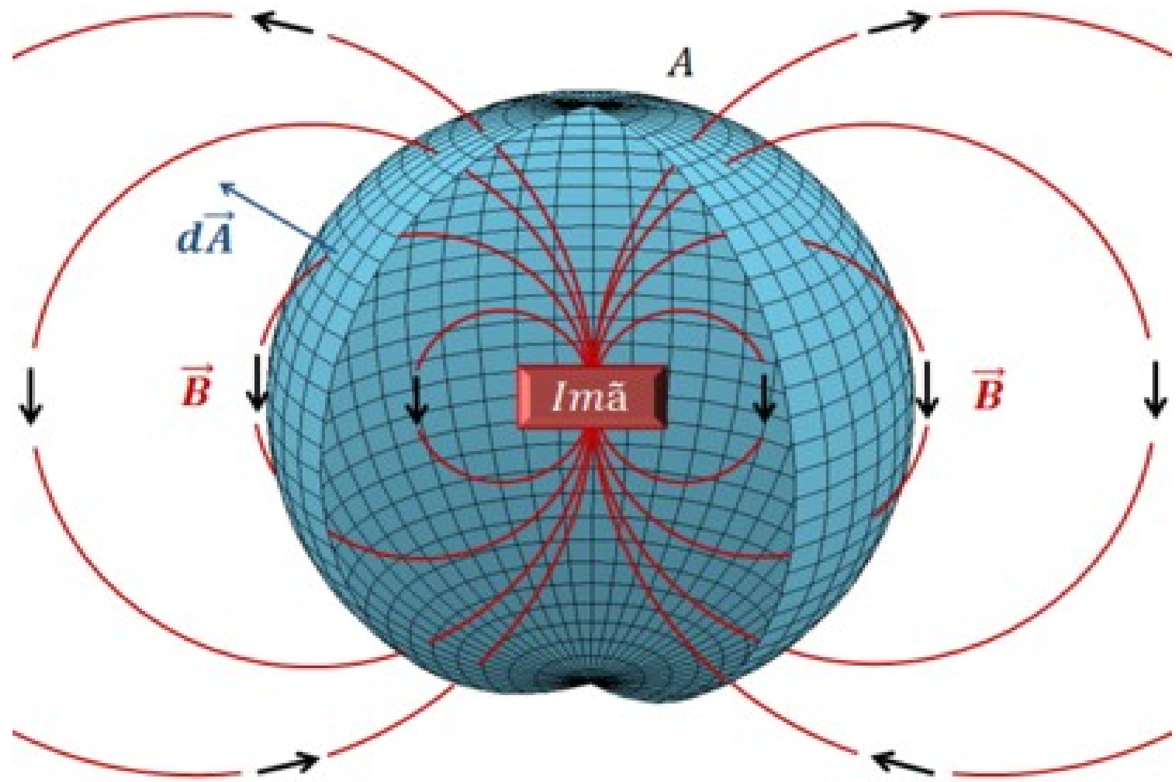
Lei de Gauss Campo Elétrico

$$\oint \vec{E}.d\vec{S} = \frac{Q}{e_0}$$



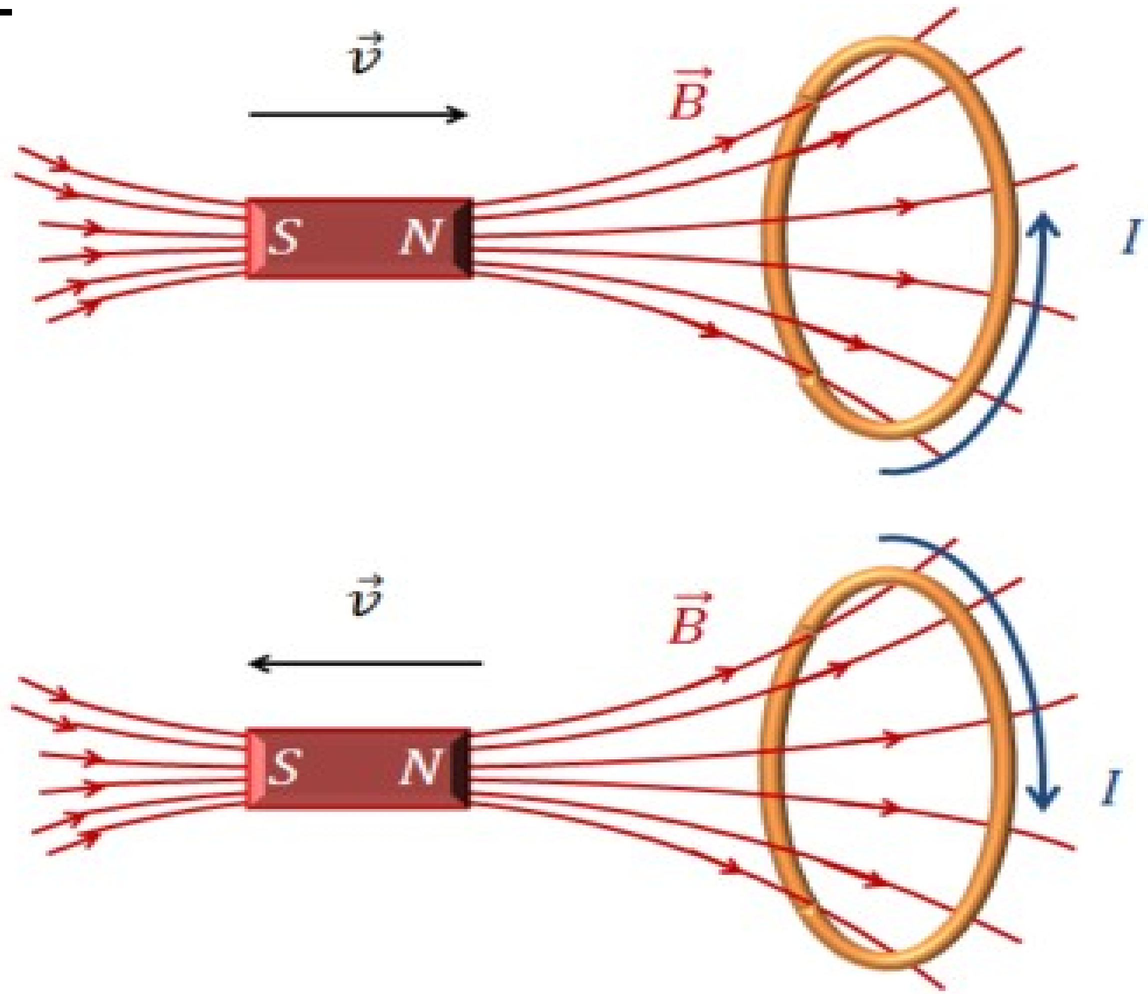
Lei de Gauss Campo Magnético

$$\oint \vec{B}.d\vec{S} = 0$$



Lei de Faraday

$$\oint \vec{E}.d\vec{l} = \frac{-d\Phi_b}{dt}$$



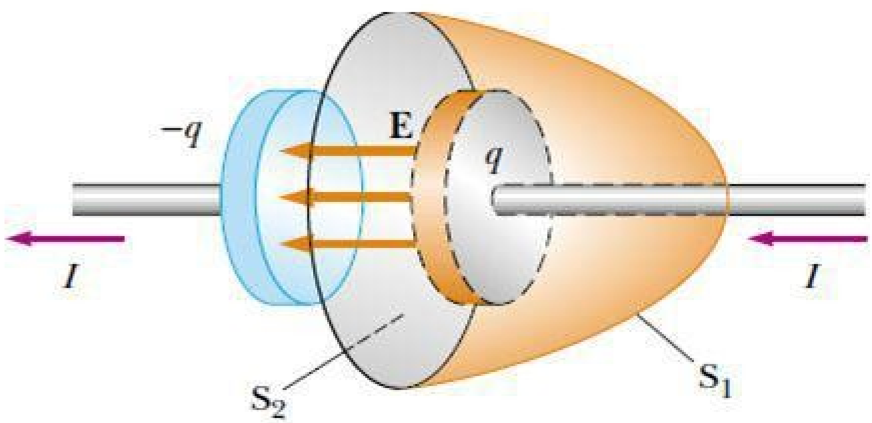
Lei de Ampère - Maxwell

$$I_d \equiv \epsilon_0 \frac{d\Phi_E}{dt}$$

Corrente de deslocamento introduzida por Maxwell para generalizar a lei de Ampère

$$\oint \mathbf{B} \cdot d\mathbf{s} = \mu_0(I + I_d) = \mu_0 I + \mu_0 \epsilon_0 \frac{d\Phi_E}{dt}$$

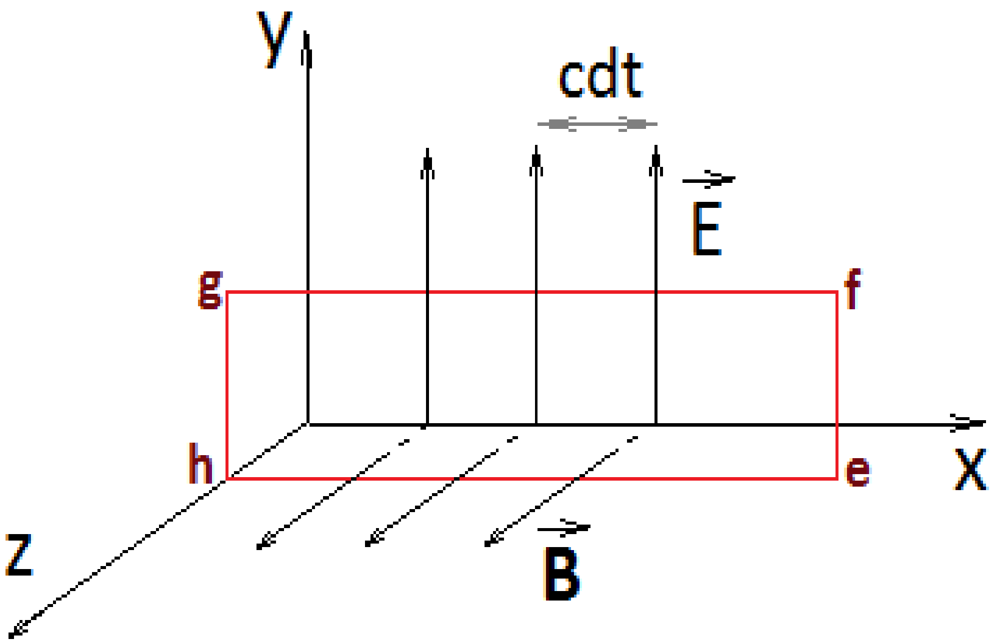
Comentário: corrente no capacitor



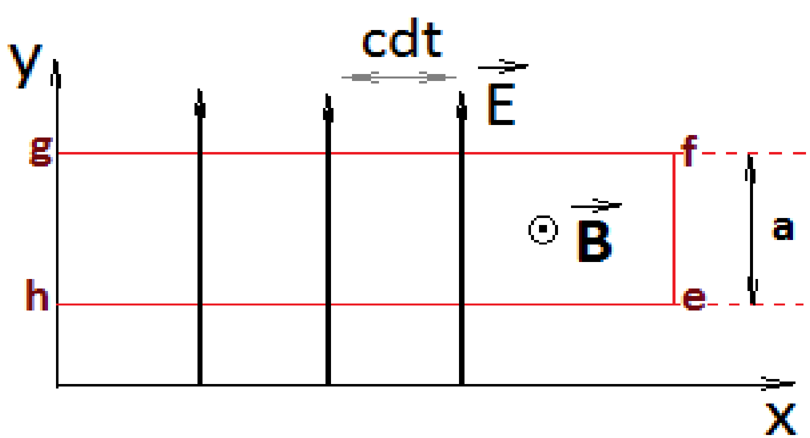
$$\Phi_E = EA = \frac{q}{\epsilon_0}$$

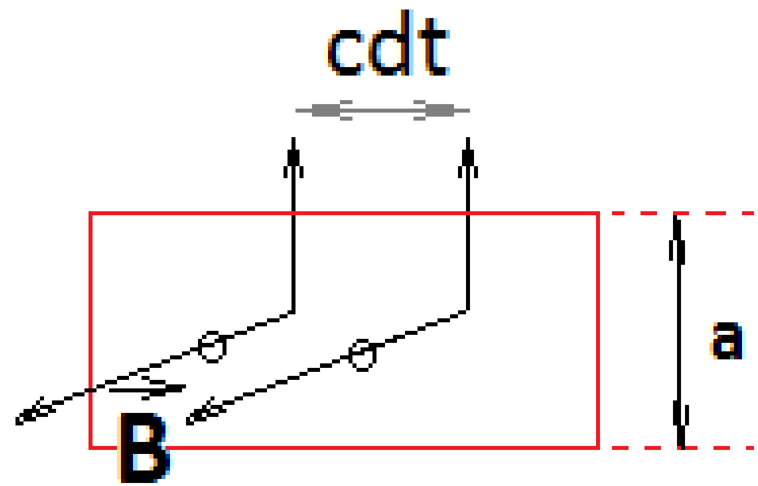
$$I_d = \epsilon_0 \frac{d\Phi_E}{dt} = \frac{dq}{dt}$$

Velocidade da luz no vácuo



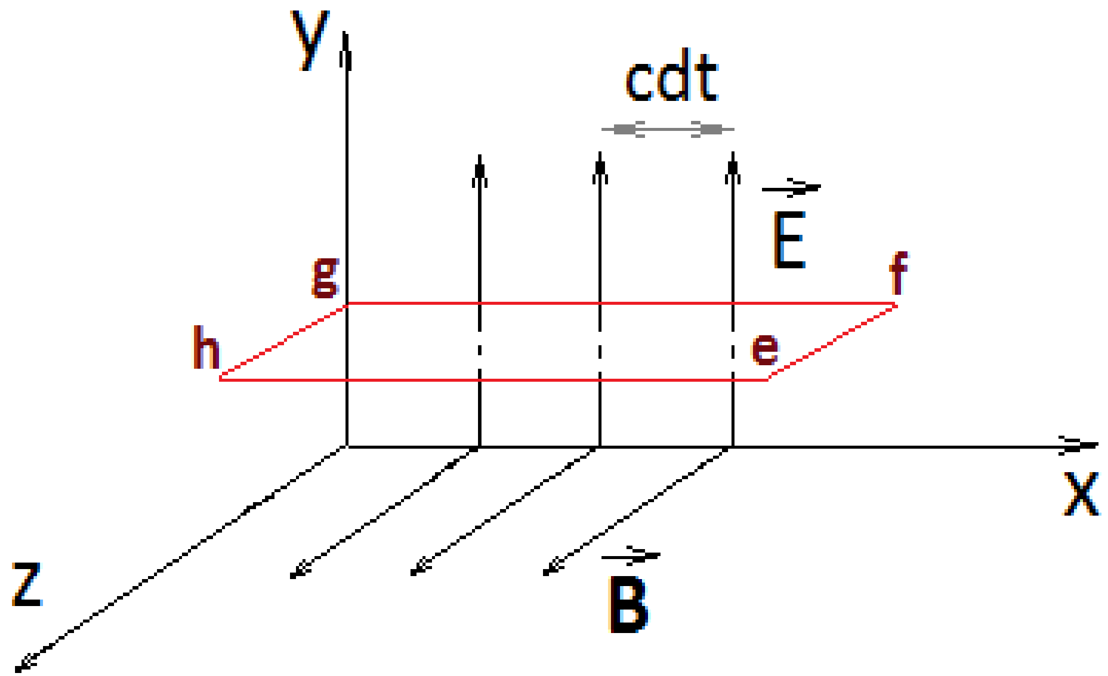
$$\oint \vec{E} . d\vec{l} = \frac{-d\,\Phi_b}{dt}$$

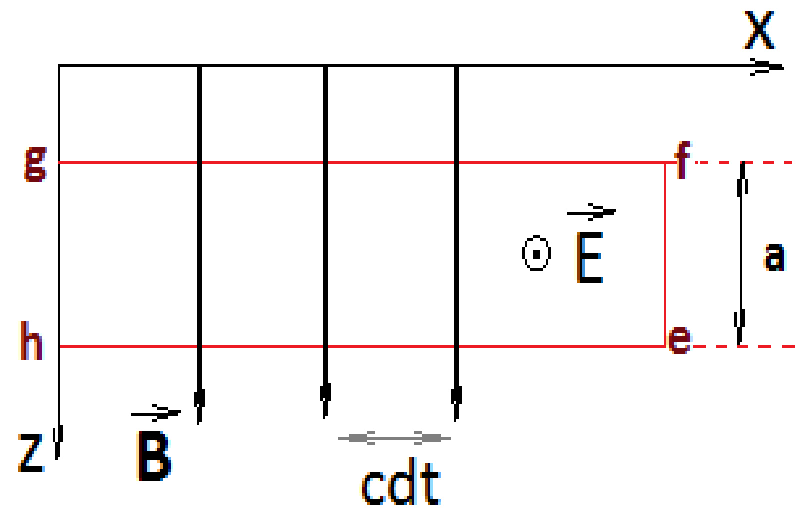




Lei de Ampère-Maxwell (vácuo)

$$\oint \vec{B}.d\vec{l} = \mu_0 \epsilon_0 \frac{d\,\Phi_E}{dt}$$



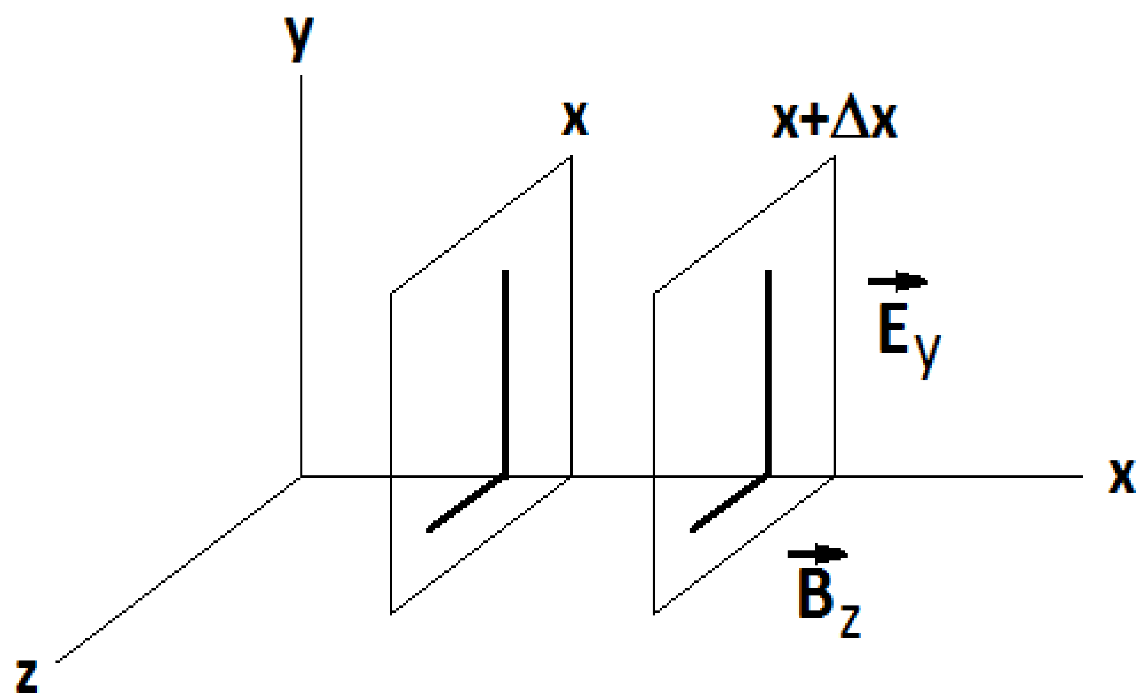


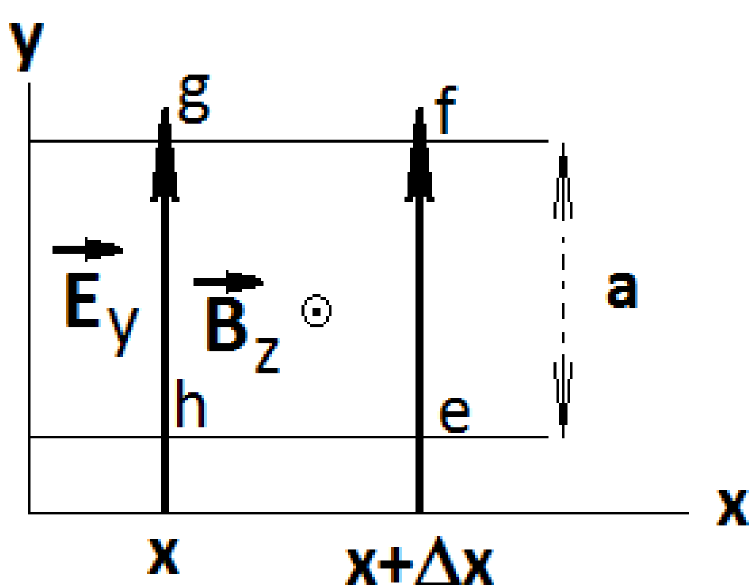
$$\mu_0 = 4\pi\, 10^{-7}\, N / A^2$$

$$\epsilon_0 = 8{,}85\, 10^{-12}\, C^2 / N.m^2$$

Equação de ondas Eletromagnéticas

$$\oint \vec{E}.d\vec{l} = \frac{-d\Phi_b}{dt}$$

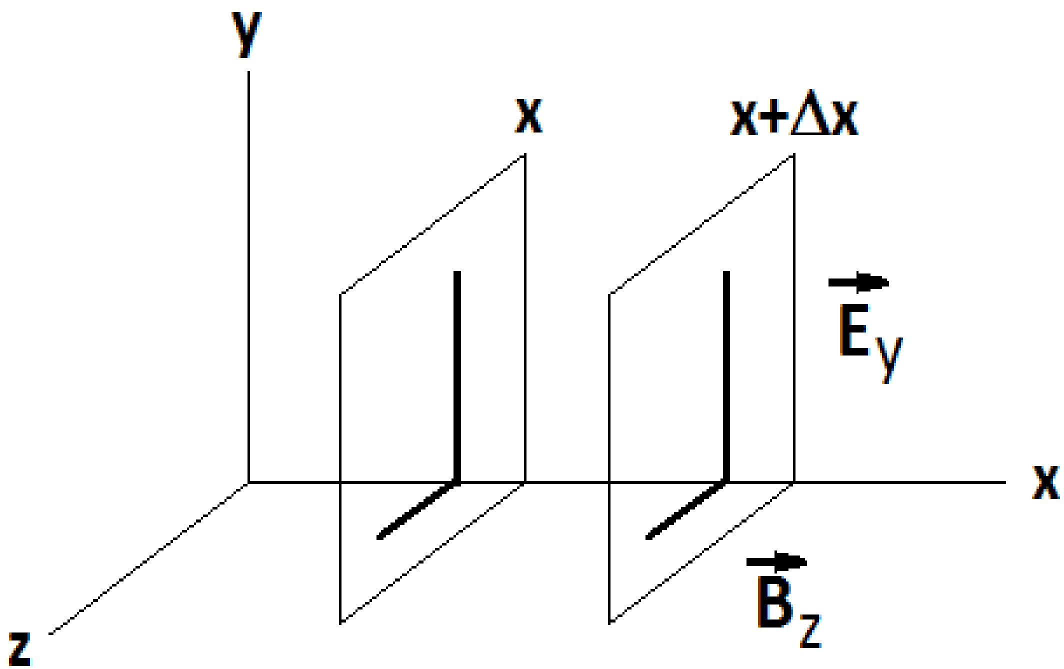


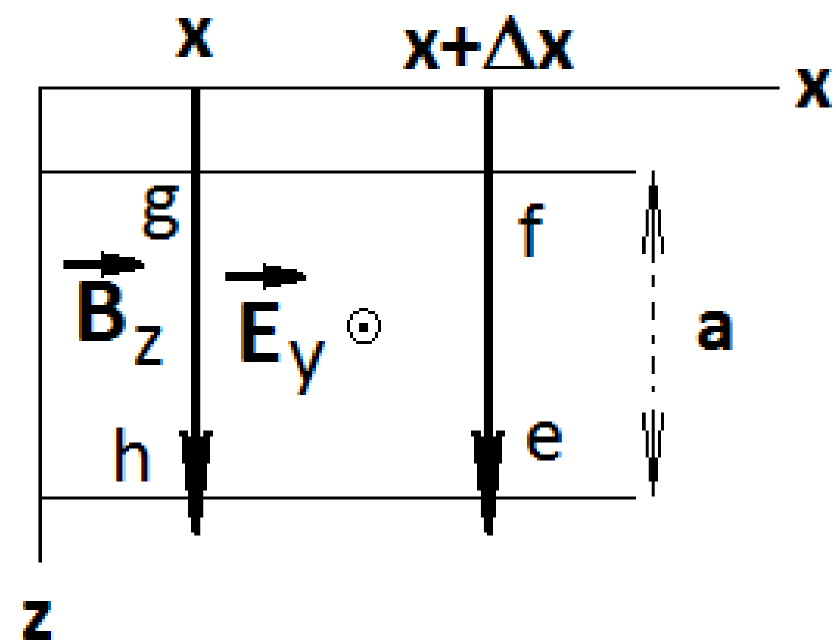


-Fluxo do campo B em (a.Δx)
-d/dt
-iguala:
-Equação I

Lei de Ampère-Maxwell (vácuo)

$$\oint \vec{B}.d\,\vec{l} = \mu_0 \epsilon_0 \frac{d\,\Phi_E}{dt}$$





-Fluxo do campo E em (a.Δx)
-d/dt
-iguala:
-Equação II

Equação de Ondas EM com E(x,t):

-Equação I: $\frac{\partial}{\partial x}$

-troca de variável
-insere Equação II

-Equação II: $\frac{\partial}{\partial x}$

-troca de variável
-insere Equação I

Soluções:

$$E(x,t)=E_{máx}\cos(kx-\omega t)\hat{y}$$

$$B(x,t)=B_{máx}\cos(kx-\omega t)\hat{z}$$