3° & 4° Maxwell Gleichungen

③ $\vec{\nabla} \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$ ④ $\vec{\nabla} \times \vec{B} = \mu_0 \vec{j} + \mu_0 \varepsilon_0 \frac{\partial \vec{E}}{\partial t}$

④ im Freiraum $\vec{J} = 0$

④: $\vec{\nabla} \times \vec{B} = \mu_0 \varepsilon_0 \frac{\partial \vec{E}}{\partial t}$ ⑤

$\vec{\nabla} \times$ ③ $\vec{\nabla} \times (\vec{\nabla} \times \vec{E}) = -\frac{\partial \vec{\nabla} \times \vec{B}}{\partial t}$

③ & ⑤ $= -\mu_0 \varepsilon_0 \frac{\partial^2 \vec{E}}{\partial t^2}$ (+)

$\vec{\nabla} \times (\vec{\nabla} \times \vec{E}) = \vec{\nabla}(\vec{\nabla} \cdot \vec{E}) - \nabla^2 \vec{E}$ (*)

1° Maxwell-Gleichung:

$\vec{\nabla} \cdot \vec{E} = \frac{\rho}{\varepsilon_0}$ ⑥

Im Freiraum $\rho = 0$

$\vec{\nabla} \cdot \vec{E} = 0$ ⑦

(*) & ⑦ : (+)

$-\nabla^2 \vec{E} = -\mu_0 \varepsilon_0 \frac{\partial^2 E}{\partial t^2}$

In 1D

$\frac{\partial^2 E}{\partial x^2} = \mu_0 \varepsilon_0 \frac{\partial^2 E}{\partial t^2}$ ⑧

$E = E_0 \cos(\omega t - kx)$

⑧: $k^2 \cancel{E} = \mu_0 \varepsilon_0 \omega^2 \cancel{E}$

$\frac{\omega}{k} = v$

⑧ $\frac{1}{\mu_0 \varepsilon_0} = \frac{\omega^2}{k^2}$

$= v^2$

$\Rightarrow v = \sqrt{\frac{1}{\mu_0 \varepsilon_0}}$

$= c$