Leistung im Wechselstrom

$$P(t) = I_0 V_0 \cos(\omega t + \varphi)\cos(\omega t) = \frac{I_0 V_0}{2}\left(\cos(2\omega t + \varphi) + \cos\varphi\right)$$

$$\cos(\alpha \pm \beta) = \cos\alpha\cos\beta \mp \sin\alpha\sin\beta$$

$$\cos(\alpha+\beta) + \cos(\alpha-\beta) = 2\cos\alpha\cos\beta$$

$\alpha = \omega t + \varphi$
$\beta = \omega t$

$\Rightarrow \alpha - \beta = \varphi$
$\alpha + \beta = 2\omega t + \varphi$

$$\langle P(t) \rangle = \frac{I_0 V_0}{2}\cos\varphi = I_{eff} \cdot V_{eff} \cdot \cos\varphi$$

$$V_{eff} = \frac{U_0}{\sqrt{2}}$$

Transformator

$$V_0 = i L_1 \omega I_{p0} \mp i L_{12} \omega I_{s0}$$

$$0 = i L_2 \omega I_{s0} \mp i L_{12} \omega I_{p0} + I_{s0} R$$

$$I_{p0} = \pm \frac{R + i\omega L_2}{i L_{12} \omega} I_{s0}$$

$$V_0 = \left[\frac{iL_1\omega}{iL_{12}\omega}\,(R+i\omega L_2) \mp iL_{12}\omega\right] I_{S0}$$

Maxwell-Gleichungen im Vakuum

$$\vec{\nabla}\cdot\vec{E} = 0 \qquad \vec{\nabla}\cdot\vec{B} = 0 \qquad \vec{\nabla}\times\vec{E} = -\frac{\partial\vec{B}}{\partial t}$$

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

$$\vec{\nabla}\times\vec{\nabla}\times\vec{E} = \vec{\nabla}\times\left(-\frac{\partial\vec{B}}{\partial t}\right) = -\frac{\partial}{\partial t}\left(\vec{\nabla}\times\vec{B}\right) = -\frac{\partial}{\partial t}\left(\mu_0\varepsilon_0\frac{\partial\vec{E}}{\partial t}\right)$$

$$\hookrightarrow \boxed{\vec{\nabla}^2\vec{E} = \mu_0\varepsilon_0\frac{\partial^2\vec{E}}{\partial t^2}} \quad \text{Wellengleichung in } \vec{E}$$

mit Wellengeschwindigkeit $c^2 = \dfrac{1}{\mu_0\varepsilon_0}$

$$c = \left(\frac{1}{4\pi\cdot 10^{-7}\frac{Vs}{Am}\, 8.85\cdot 10^{-12}\frac{As}{Vm}}\right)^{1/2} = \left(\frac{1}{100\cdot 10^{-19}}\right)^{1/2} \frac{m}{s}$$

$$= \left(10^{17}\right)^{1/2} \, m/s \hat{=} 3\cdot 10^{8}\, m/s$$