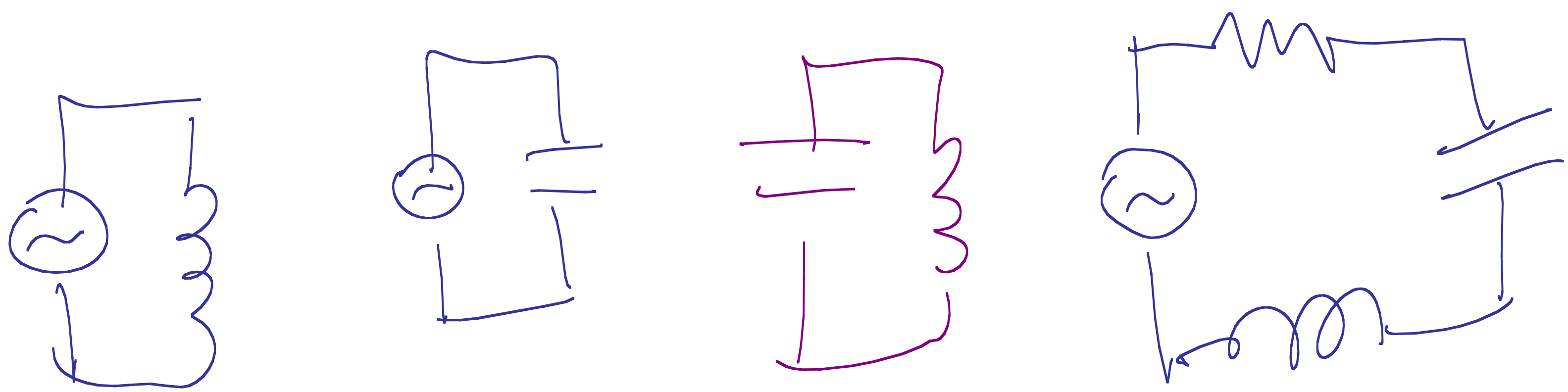
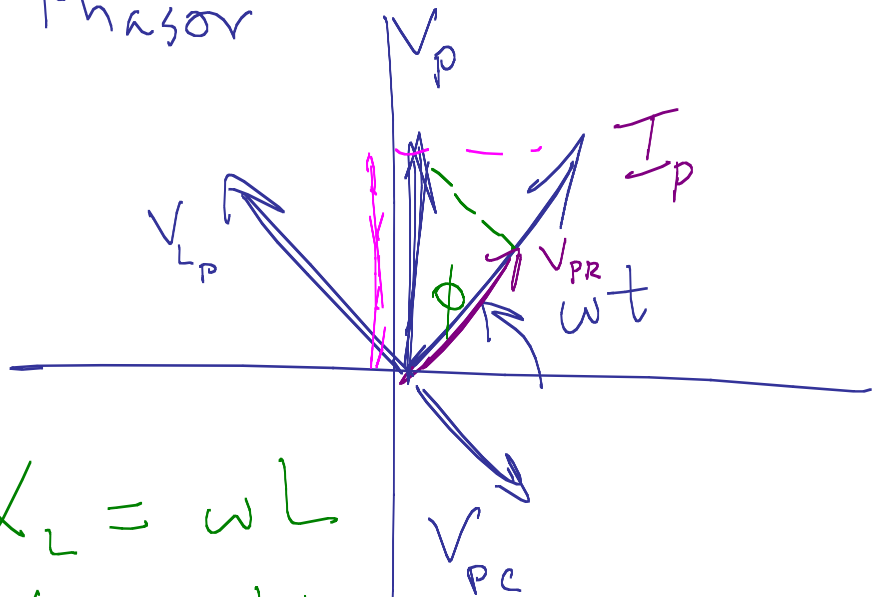
Phys 2120-4 11/05/12

Note Title 11/5/2012

Review: AC circuits



Phasor



$$X_L = \omega L$$

$$X_c = 1/\omega C$$

$$V_{pR} = V_p \cos\phi$$

$$\tan\phi = \frac{X_L - X_c}{R}$$

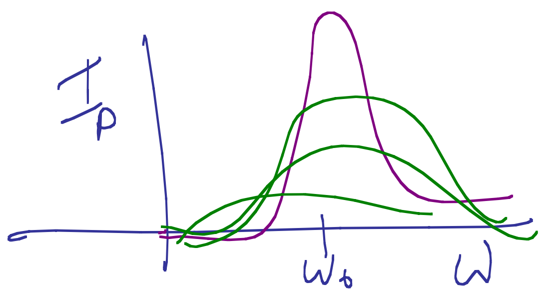
$$I_p = \frac{V_p}{\sqrt{R^2 + (X_L - X_c)^2}}$$

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

$$I_p = \frac{V_p}{Z} \qquad \omega_0 = \frac{1}{\sqrt{LC}}$$

When $\omega = \omega_0$ then X's cancel.

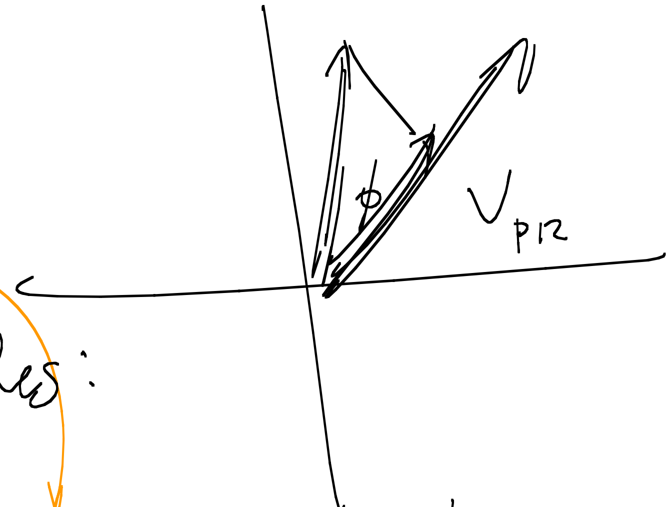
$$Z = R$$



Q f_m

Power Dissipation:

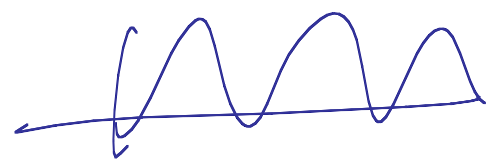
$$V_{pR} = V_p \cos\phi$$



Instantaneous power in Res:

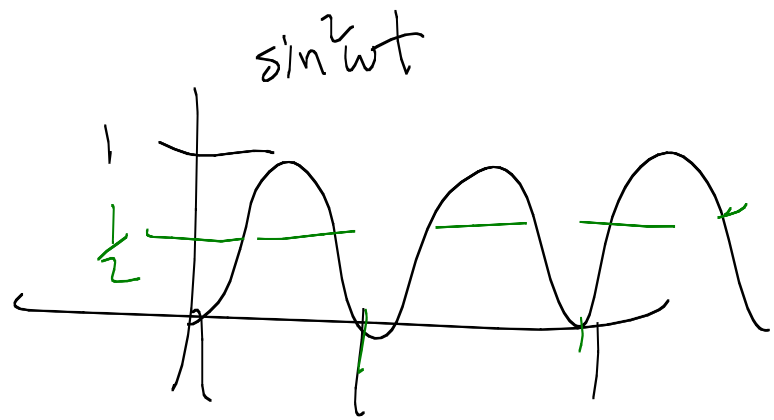
$$P = I_R V_R = (I_p \sin\omega t)(V_p \cos\phi)\sin\omega t$$

$$= I_p V_p \cos\phi \sin^2\omega t$$



whe avg power

$$P = I_p V_p \cos\phi \sin^2 \omega t$$



$$\sin^2 \omega t \rightarrow \frac{1}{2}$$

$$\langle P \rangle = \frac{1}{2} I_p V_p \underline{\cos\phi}$$

$$\frac{1}{T}\int_0^T \sin^2 \omega t = \frac{1}{2}$$

power factor

$$I_{rms} = \frac{V_p}{\sqrt{2}} \qquad V_{rm} = \frac{V_p}{\sqrt{2}}$$

$$\langle P \rangle = I_{rms} V_{rms} \cos\phi$$

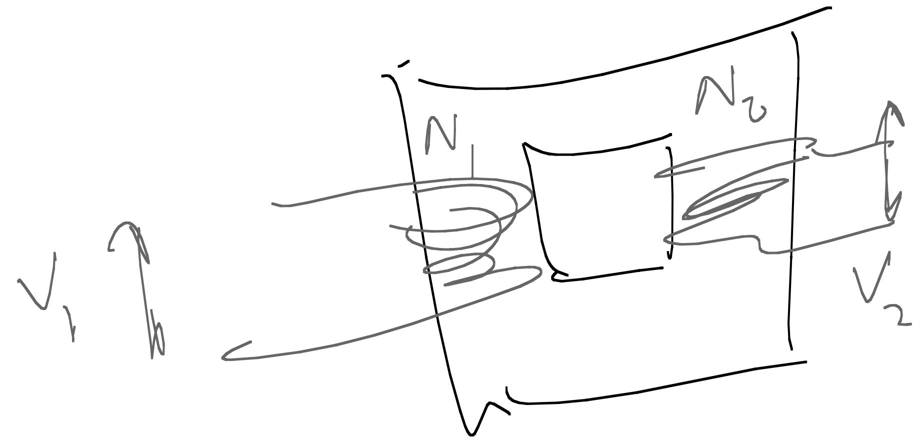
p. 502

28.33 Elec. drill draws 4.6 A rms at 120 rms, Current lags voltage by 25°. What's power consumption?

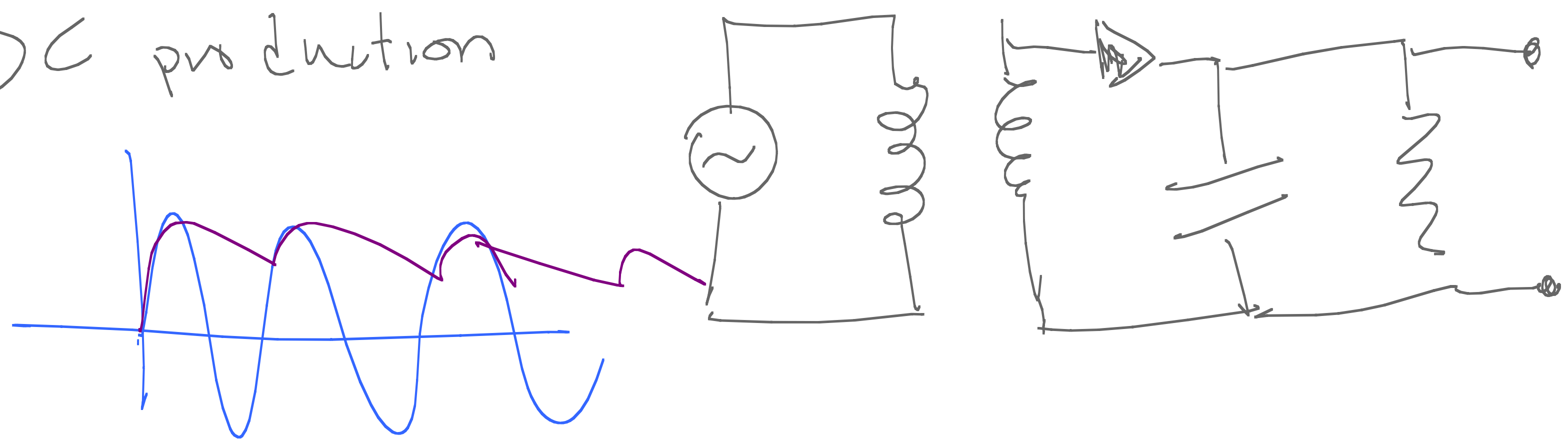
$$\langle P \rangle = I_{rms} V_{rms} \cos 25^\circ = \boxed{500\,W}$$

Transformer

$$V_2 = \frac{N_2}{N_1} V_1$$



DC production



Chap 29

Recap:

Elec/Mag $\Rightarrow$ Optics

$$\oint \vec{E} \cdot d\vec{A} = q_{encl}/\epsilon_0$$

Gauss

$$\oint \vec{E} \cdot d\vec{r} = - \frac{d\Phi_B}{dt}$$

Faraday

$$\oint \vec{B} \cdot d\vec{A} = 0$$

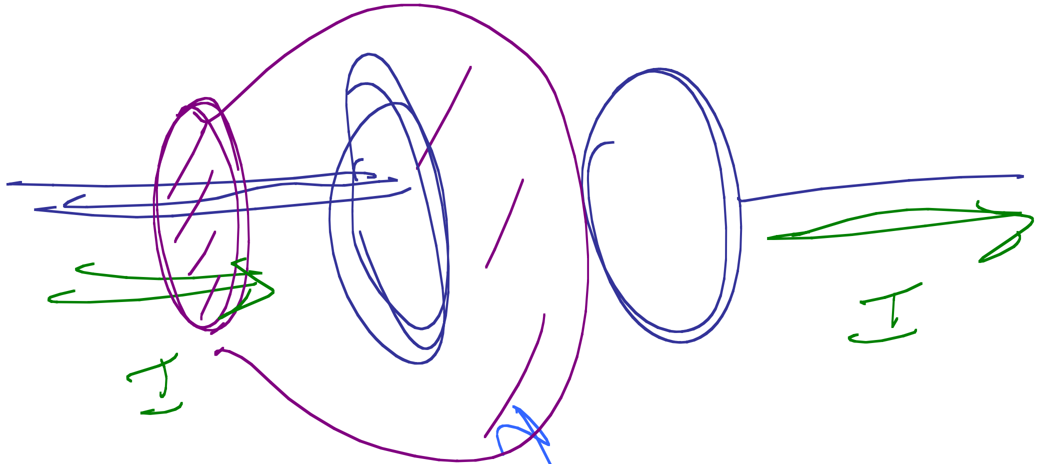
Gauss' Law Mag

$$\oint \vec{B} \cdot d\vec{r} = \mu_0 I_{encl}$$

Ampere

Maxwell:

Ampere's Law should be fixed.



$\int B\cdot dr$

No current

Φ_E on this surface is changing.

$$\oint \vec{B}\cdot d\vec{r} = \mu_0 I + \mu_0 \epsilon_0 \left(\frac{d\Phi_E}{dt}\right)$$

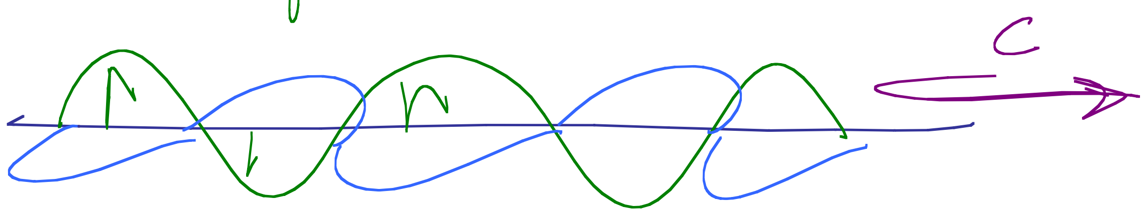
Correct statement of Ampere

$$\frac{d\Phi_E}{dt}$$ "Displacement current"

Changing B field $\longrightarrow$ Changing E field

$\longrightarrow$ Changing B field.

Waves of elec & magnetism through space



$$c = \frac{1}{\sqrt{\epsilon_0 \mu_0}}$$