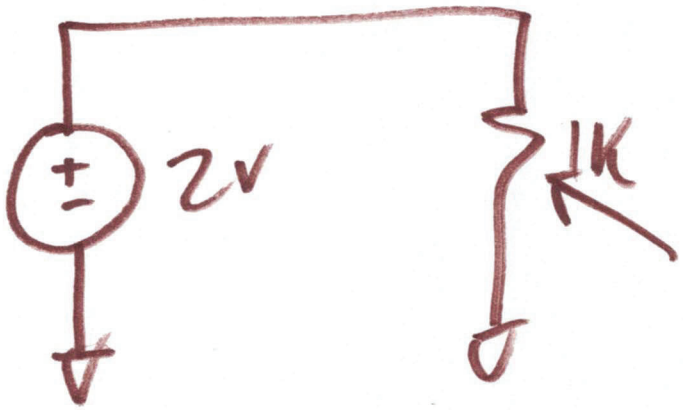
EE 221 Circuits II

$V_{rms} = 2 = V_P/\sqrt{2}$

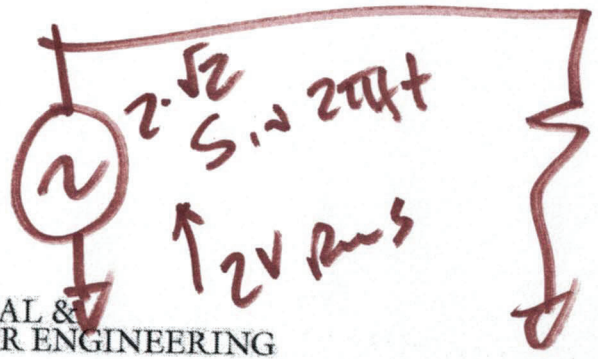
Lecture 25

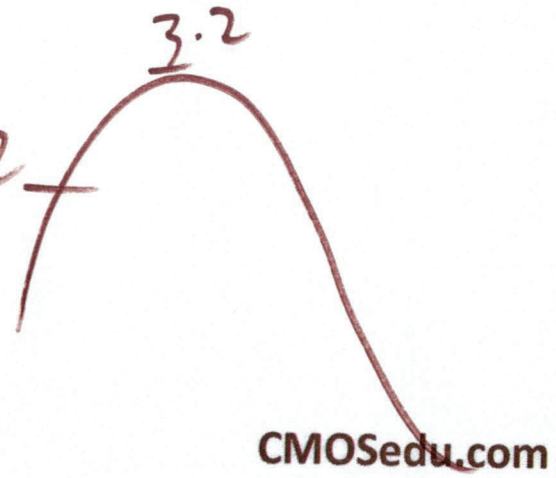
April 28, 2021

$V_P = 2\sqrt{2}$



$\frac{V^2}{R} = \frac{4}{1K} = 4\text{-}W$





$$X_{AVG} = \frac{1}{T}\int_0^T x(t)\,dt$$

Sum

$$X_{rms} = \sqrt{\frac{1}{T}\int_0^T x^2(t)\cdot dt}$$

$$f = \frac{1}{T}$$

$$X_{AVG} = \frac{1}{T}\int_0^{T/2} 5\cdot dt$$

Duty cycle = 50%

$$= \sqrt{\frac{1}{T}\int_0^{T/2} 25\cdot dt}$$

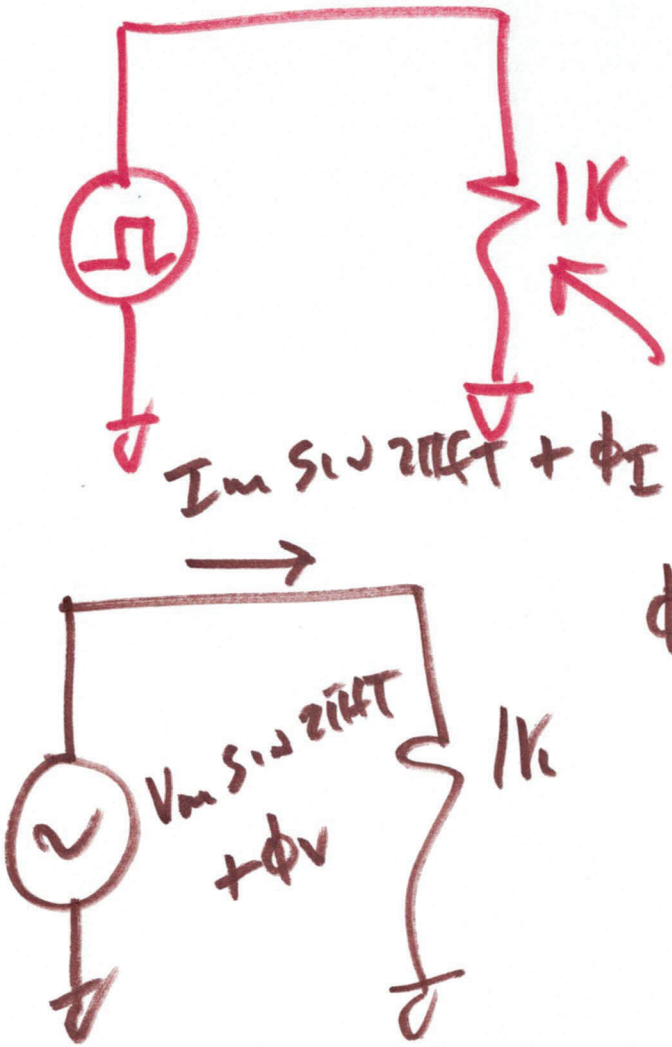
$$X_{AVG} = \frac{1}{T}\,5\cdot t\Big|_0^{T/2}$$

$$= \sqrt{\frac{1}{T}\,25t\Big|_0^{T/2}} = \sqrt{\frac{25}{2}}$$

$$= \frac{1}{T}\,5\left(T/2 - 0\right)$$

$$= \frac{5}{\sqrt{2}}$$

$$X_{AVG} = 2.5\,V$$

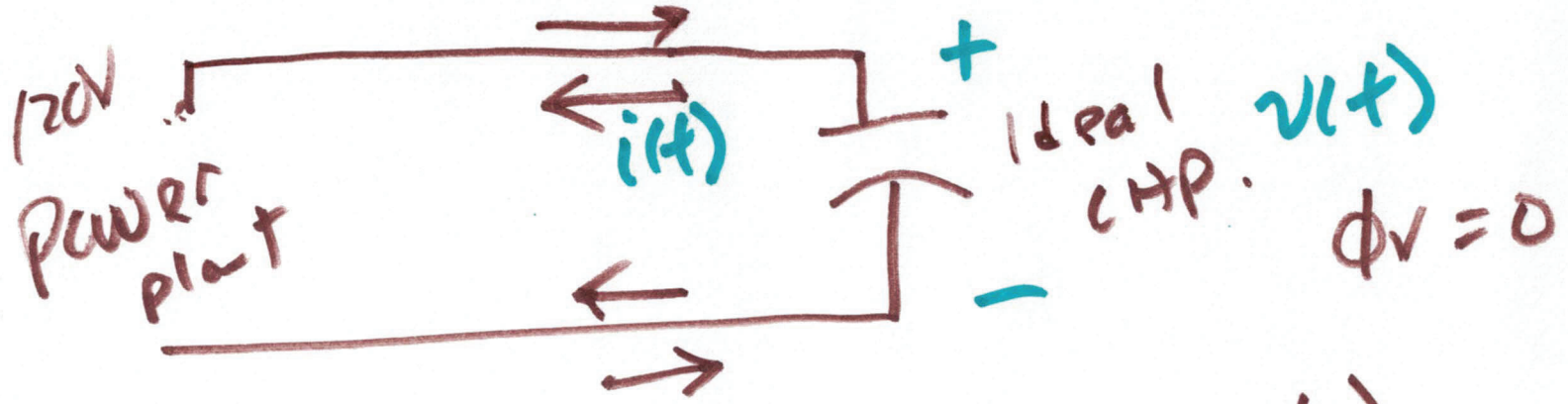


$$\text{Power} = \frac{V_{Rms}^2}{R} = \frac{\left(\frac{5}{\sqrt{2}}\right)^2}{R}$$

$$\phi_V = \phi_I = \frac{25/2}{R}$$

$$= \frac{12.5}{R} = 12.5 \text{ W}$$

Right!



$$v(t) = V_m \cos(\omega t + \phi_V)$$

$$i(t) = I_m \cos(\omega t + \phi_I)$$

$$\frac{1}{j\omega} = \frac{1}{\omega \angle 90} = \frac{1}{j\omega C}$$

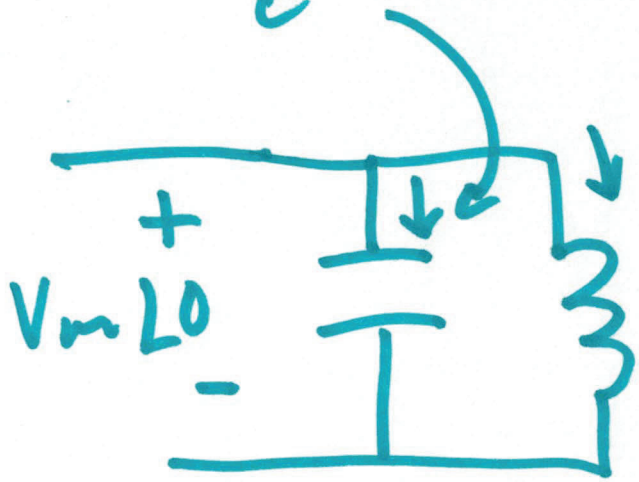
$$+ \quad V_m \angle 0 \quad -$$

$$I_m = \frac{V_m \angle 0}{\frac{1}{\omega C} \angle -90} = \omega C V_m \angle 90$$

$$V_m \omega C \angle 90$$

$i_c(t) = V_m \omega C \cos(\omega t + 90)$

$i_L = \frac{V_m}{\omega L} \cos(\omega t - 90)$



$j\omega L = \omega L \angle 90$

$$\underline{I}_L = \frac{V_m \angle 0}{\omega L \angle 90} = \frac{V_m}{\omega L} \angle -90$$

$V_m \omega C = \frac{V_m}{\omega L}$

$\omega^2 = \frac{1}{LC}$

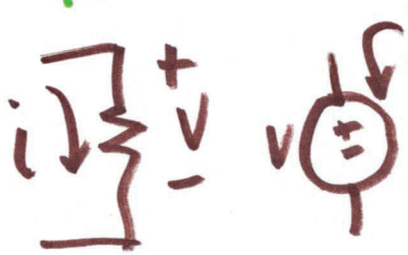
$$I_C = C\omega \angle 90$$

$f = \frac{1}{2\pi\sqrt{LC}}$ $i_L = -i_C \Rightarrow$ total current $\downarrow 0$

$v(t) = V_m \cos(\omega t + \phi_V)$ displacement

$i(t) = I_m \cos(\omega t + \phi_I)$

instantaneous $p(t) = v(t) \cdot i(t)$



$p(t) = V_m I_m \cos(\omega t + \phi_V)\cos(\omega t + \phi_I)$

$\cos x \cos y = \frac{1}{2}\cos(x-y) + \frac{1}{2}\cos(x+y)$

$$p(t) = \frac{V_m I_m}{2} \cdot \cos(\phi_V - \phi_I) + \frac{V_m I_m}{2} \cdot \cos(2\omega t + \phi_V + \phi_I)$$

$\cos(2\omega t + \phi_V + \phi_I) \to 0$

$$P_{AVG} = \frac{1}{T}\int_0^T p(t) \cdot dt$$

$$P_{AVG} = \frac{V_m I_m}{2} \cos(\phi_V - \phi_I) \cdot \frac{1}{I}(I - 0)$$

$$P_{AVG} = \frac{V_m}{\sqrt{2}} \frac{I_m}{\sqrt{2}} \cdot \cos(\underbrace{\phi_V - \phi_I}_{\text{power factor Angle}})$$