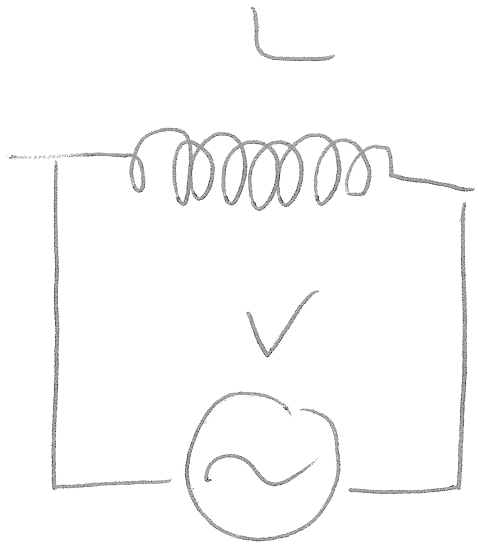


$$V(t) = V_{MAX}\, e^{i\omega t}$$

$$V(t) - L\frac{dI}{dt} = 0$$

$$V_{MAX}\, e^{i\omega t} - L\frac{dI}{dt} = 0$$

$$V_{MAX}\, e^{i\omega t} = L\frac{dI}{dt}$$

$$\frac{dI}{dt} = \frac{V_{MAX}}{L}\, e^{i\omega t}$$

$$I(t) = \frac{V_{MAX}}{i\omega L}\, e^{i\omega t}$$

$$e^{i\theta} = \cos\theta + i\sin\theta$$

$$-i = e^{-i\pi/2}$$

$$i^2 = -1$$

$$I(t) = -\frac{i V_{MAX}}{\omega L}\, e^{i\omega t}$$

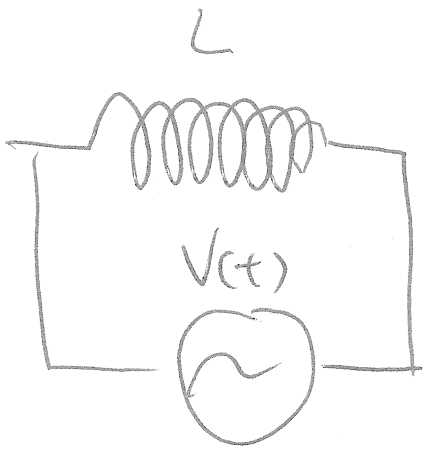
$$I(t) = \frac{V_{MAX}}{\omega L}\, e^{i\omega t - i\pi/2}\, e$$

$$I(t) = \frac{V_{MAX}}{\omega L}\, e^{i(\omega t - \pi/2)}$$

COMPLEX IMPEDANCE

$$\boxed{Z_L = i\omega L}$$

EXAMPLE



GIVEN $V(t)$

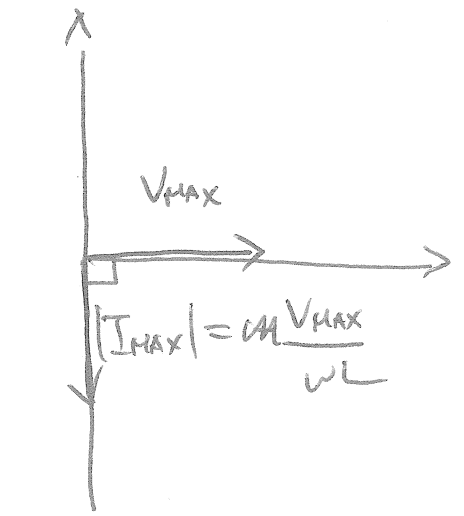
WHAT IS $I(t)$

$$V(t) = I(t)\, Z_{TOTAL}$$

$$V(t) = I(t)\, i\omega L$$

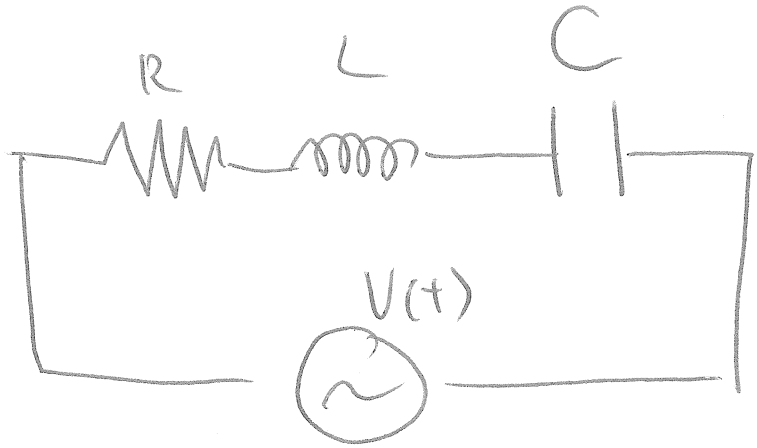
$$I(t) = \frac{V(t)}{i\omega L} = -i\,\frac{V(t)}{\omega L}$$

$$I_{MAX}\, e^{i\omega t} = \frac{-i}{\omega L}\, V_{MAX}\, e^{i\omega t}$$



↖ CURRENT LAGS VOLTAGE BY 90°

"RLC" CIRCUIT



$$Z_{TOTAL} = R + i\omega L + \frac{1}{i\omega C}$$

$$Z_{TOTAL} = R + i\left(\omega L - \frac{1}{\omega C}\right)$$

WHAT'S THE MAGNITUDE OF COMPLEX IMPEDANCE

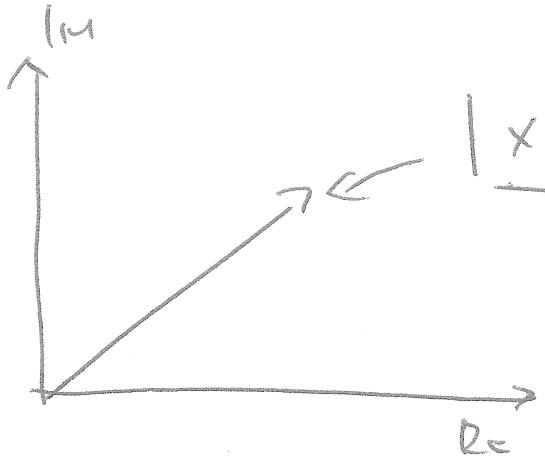
$$|Z_{TOTAL}| = \sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}$$

$\underline{I(t)} \overset{?}{\in} \underline{V(t)}$ $\quad I(t) = \dfrac{V(t)}{Z_{TOTAL}}$

$$= \frac{V(t)}{R + i\left(\omega L - \frac{1}{\omega C}\right)}$$

$$= \frac{V(t)}{R + i\left(\omega L - \frac{1}{\omega C}\right)} \times \frac{R - i\left(\omega L - \frac{1}{\omega C}\right)}{R - i\left(\omega L - \frac{1}{\omega C}\right)}$$

$$I(t) = \frac{V(t)\left[R - i\left(\omega L - \frac{1}{\omega C}\right)\right]}{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}$$

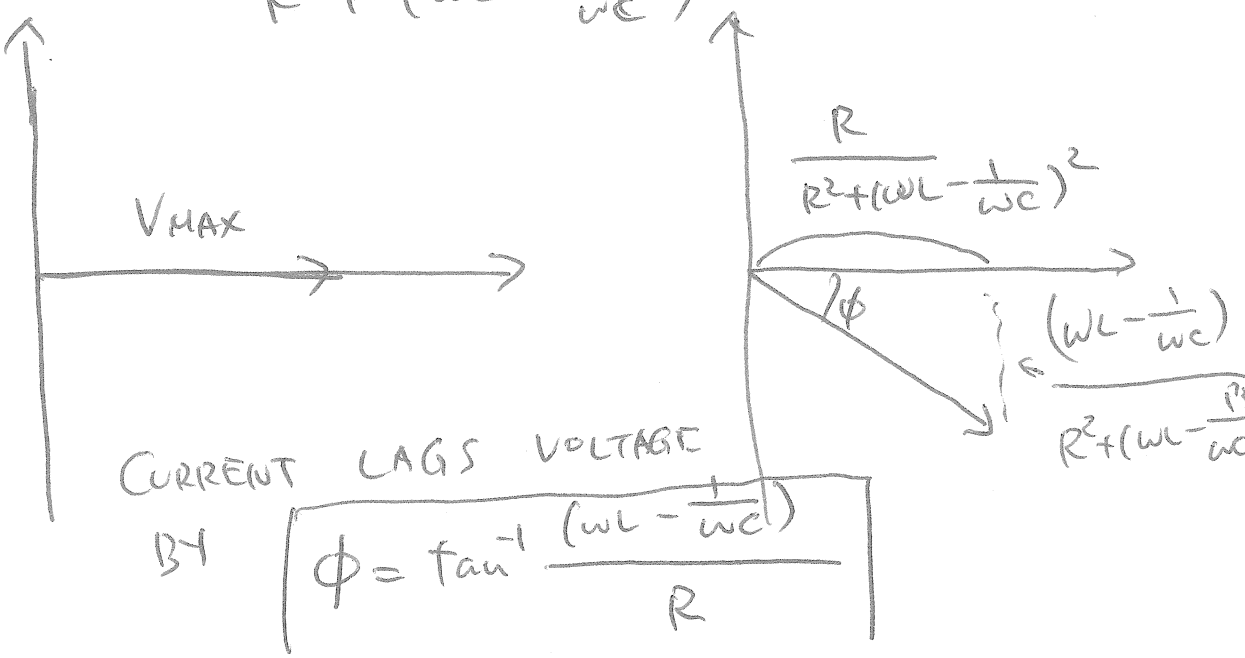


$$|x+yi| = \sqrt{x^2+y^2}$$

$$|I(t)| = \sqrt{\frac{R^2+\left(\omega L-\frac{1}{\omega C}\right)^2}{\left(R^2+\left(\omega L-\frac{1}{\omega C}\right)^2\right)^2}}\,|V(t)|$$

$$I_{MAX} = \frac{1}{\sqrt{R^2+\left(\omega L-\frac{1}{\omega C}\right)^2}}\,V_{MAX}$$

$$I(t) = \frac{V(t)\left[R - i\left(\omega L-\frac{1}{\omega C}\right)\right]}{R^2+\left(\omega L-\frac{1}{\omega C}\right)^2}$$



CURRENT LAGS VOLTAGE BY $\phi = \tan^{-1}\dfrac{\left(\omega L-\frac{1}{\omega C}\right)}{R}$

POWER DELIVERED TO THE CIRCUIT

$$P = IV \qquad I = \frac{V}{Z_{TOTAL}}$$

$$P = \frac{V^2}{Z_{TOTAL}}$$

$$P = \frac{V^2}{|Z_{TOTAL}|} \qquad P_{MAX} = \frac{V_{MAX}^2}{\sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}}$$