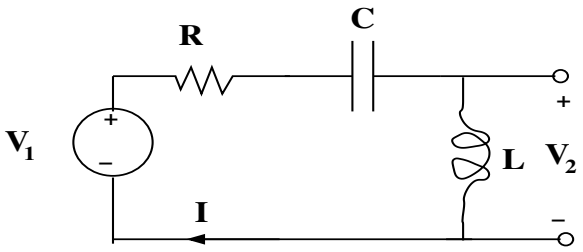
School of Engineering
Department of Electrical and Computer Engineering

332:221 **Principles of Electrical Engineering I** **Fall 2012**
Quizlette 10

USING A CALCULATOR WILL SLOW YOU DOWN! Final answers must appear in the appropriate box. Show your work outside the box.

1. **Basic Stuff:**



Assume sinusoidal steady state operation at some frequency ω and suppose $\mathbf{V}_1 = Ve^{j\theta}$ and $\mathbf{I} = Ie^{j\phi}$.

(a) *(1 pts)* What is the maximum value (amplitude) of the input voltage $V_1(t)$? $\boxed{V}$

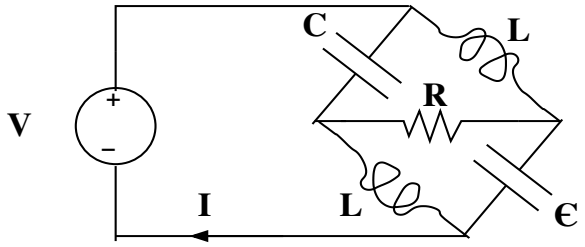
(b) *(1 pts)* What is the RMS value of the input voltage $V_1(t)$? $\boxed{\{V_1(t)\}_{\textbf{\textit{RMS}}} = \frac{V}{\sqrt{2}}}$

(c) *(1 pts)* Which is larger, $\max_t V_1(t)$ or $\{V_1(t)\}_{\text{RMS}}$ $\boxed{V_{\textbf{\textit{RMS}}} \textbf{\textit{ is smaller.}}}$

(d) *(2 pts)* What is the average power *supplied to* the resistor, capacitor and inductor?

$$\boxed{\overline{P} = \tfrac{1}{2}\mathbf{V}\mathbf{I}^* = \tfrac{VI}{2}\Re\{e^{j(\theta-\phi)}\} = \tfrac{VI}{2}\cos(\theta-\phi)}$$

2. **VERY Cute:** Assume sinusoidal steady state at some frequency ω.



(a) *(2 pt)* Assume $\mathbf{V} = Ve^{j\theta}$ and $\mathbf{I} = Ie^{j\theta}$. What is the amplitude of the voltage across the resistor?

$\frac{V_R^2}{R} == \Re\{VI^*\} = VI$ ***so*** $V_R = \sqrt{RVI}$

(b) *(3 pts)* At what value of ω (if any) does V_R, the voltage across the resistor, equal zero?

When the bridge is balanced:

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

implies

$$LC\omega^2 = -1$$

which is impossible.