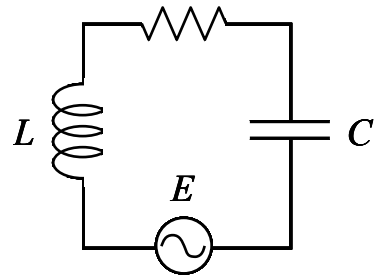


**Discussion Question 11D**  
**P212, Week 11**  
***RLC Circuits***

- (a) Calculate the maximum EMF  $\mathcal{E}_m$  and the maximum current  $I_m$  in the RLC circuit described at right.**

The “rms” = root-mean-square value of anything oscillating sinusoidally is its peak value divided by  $\sqrt{2}$ .



$$\begin{aligned} R &= 200 \, \Omega \\ L &= 40 \, \text{mH} \\ C &= 0.20 \, \mu\text{F} \\ E_{\text{rms}} &= 120 \, \text{V} \\ \omega &= 10^4 \, \text{rad/sec} \end{aligned}$$

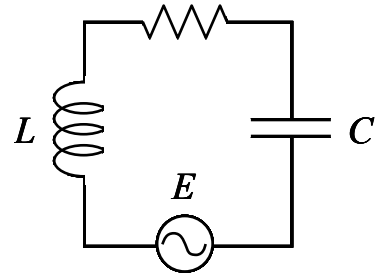
- (b) Find the magnitude and sign of the phase  $\phi$  by which the driving EMF leads the current.**

A negative phase means that the driving EMF *lags* the current ... which is the case here?  
Does your answer make sense given the reactances you calculated earlier?

- (c) Draw the phasor diagram for this circuit, giving numerical values for the lengths of each phasor ( $\mathcal{E}$ ,  $V_R$ ,  $V_C$ ,  $V_L$ ).**

Be sure to draw your diagram carefully: use longer phasors for larger peak voltages.

(d) What is the resonant frequency  $\omega_0$  of this circuit?



$$R = 200 \, \Omega$$

$$L = 40 \, \text{mH}$$

$$C = 0.20 \, \mu\text{F}$$

$$E_{\text{rms}} = 120 \, \text{V}$$

$$\omega = 10^4 \, \text{rad/sec}$$

(e) Calculate the maximum energies  $U_{L,\text{max}}$  and  $U_{C,\text{max}}$  stored in the inductor and capacitor.

(f) Assume that the angular frequency  $\omega$  of the generator is variable. For what  $\omega$  is the total impedance  $Z$  equal to  $2R$ ? *Hint- you will get a quadratic equation.*