

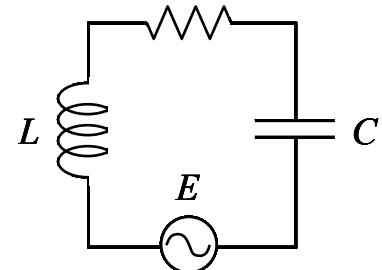
## Discussion Question 11D

P212, Week 11

*RLC Circuits*

**(a) Calculate the maximum EMF  $E_m$  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  $\sqrt{2}$ .



$$R = 200 \Omega$$

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

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

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

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

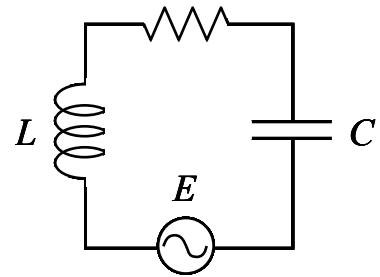
**(b) Find the magnitude and sign of the phase  $\phi$  by which the driving EMF leads the current.**

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 ( $E$ ,  $V_R$ ,  $V_C$ ,  $V_L$ ).**

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.