

ECE 211: Lab #9

Phasors and RC Circuits

Note: The phasor impedance of resistors, inductors, and capacitors are

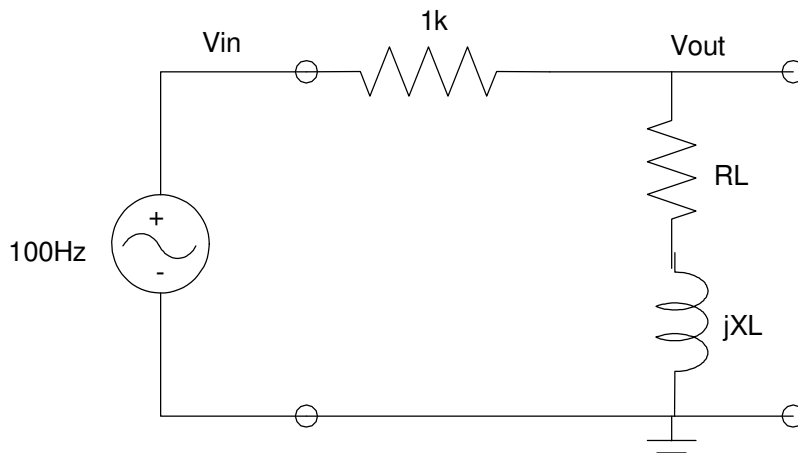
$$R \rightarrow R \quad L \rightarrow j\omega L \quad C \rightarrow \frac{1}{j\omega C}$$

1) Pick a resistor, inductor, and capacitor from the bin. Record it's value and compute its impedance at 100Hz (628 rad/sec). Note that the inductor has a resistance (due to the length of wire used) as well as an inductance.

	R	L		C
		R (DC resistance)	L	
Value				
Impedance at 100Hz				

2a) Using phasor analysis, compute the voltage at Y

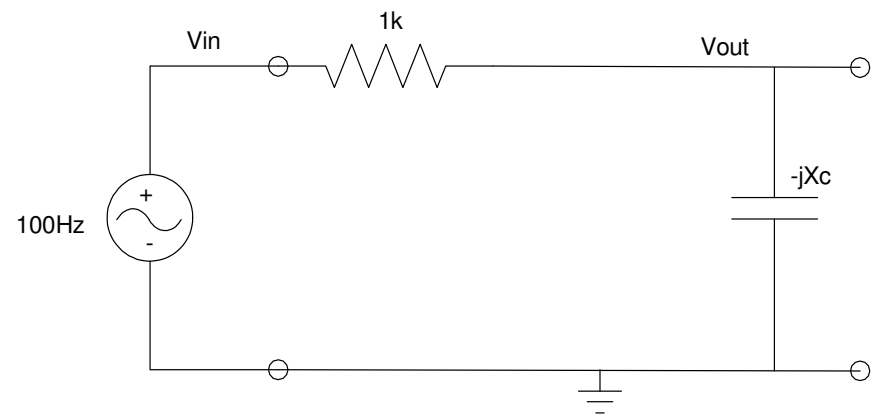
2b) Build this circuit and compute the gain and phase shift from V_{in} to V_{out}



Circuit for part 2. Note: the inductor produces R_L and jX_L
(you don't have to add a resistor in series with the inductor: it has a resistance R_L built in.)

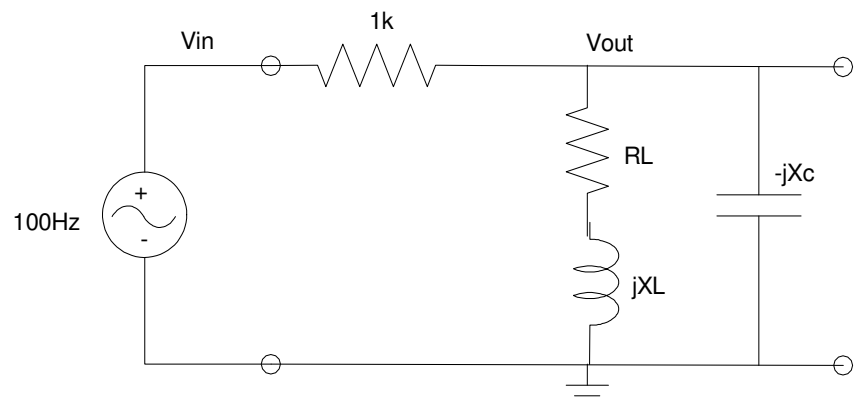
	Calculated	Measured
Gain V_{out} / V_{in}		
Phase Shift V_{out} / V_{in}		

- 3a) Using phasor analysis, compute the voltage at Y
- 3b) Build this circuit and compute the gain and phase shift from V_{in} to V_{out}



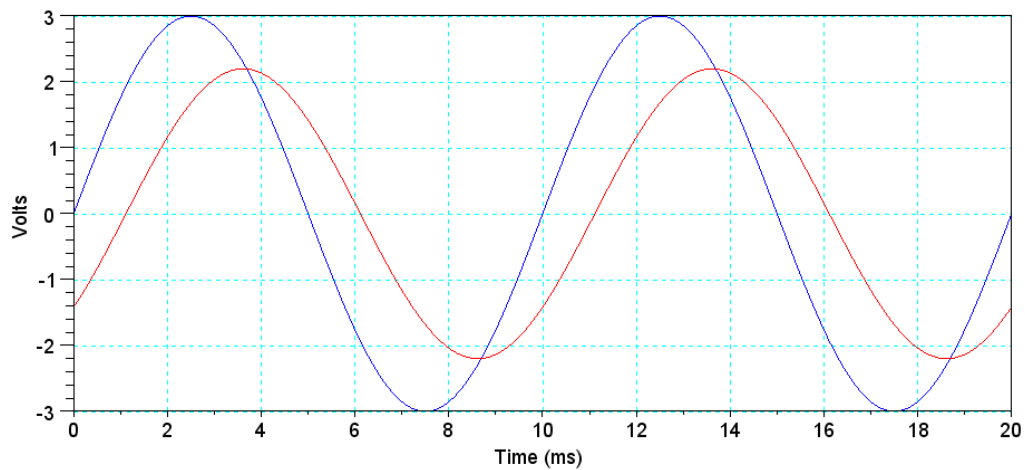
	Calculated	Measured
Gain V_{out} / V_{in}		
Phase Shift V_{out} / V_{in}		

- 4a) Using phasor analysis, compute the voltage at Y
- 4b) Build this circuit and compute the gain and phase shift from V_{in} to V_{out}



	Calculated	Measured
Gain V_{out} / V_{in}		
Phase Shift V_{out} / V_{in}		

Sample Calculations: To measure the gain and phase shift at 100Hz, display both V_{in} and V_{out} on the oscilloscope. For example, if the traces look like the following:



Sample Voltages: V_{in} (blue) and V_{out} (red)

Gain Calculations:

$$\text{Output} = \text{Gain} * \text{Input}$$

If you use the peak voltages

$$\text{gain} = \left(\frac{3V}{2.2V} \right) = 1.36$$

Phase Calculations:

One cycle is 360 degrees. The output (red line) is delayed from the input by

$$\theta = \left(\frac{1\text{ms delay}}{10\text{ms period}} \right) \cdot 360^\circ = -36^\circ$$

(negative phase is a delay, positive phase is a time advance)

The gain at 100Hz for this graph is thus

$$V_{out} = (1.36 \angle -36^\circ) \cdot V_{in}$$