ECE 209L - PHASOR CIRCUITS - LAB 4
IMPEDANCES AND KIRCHHOFF'S LAWS

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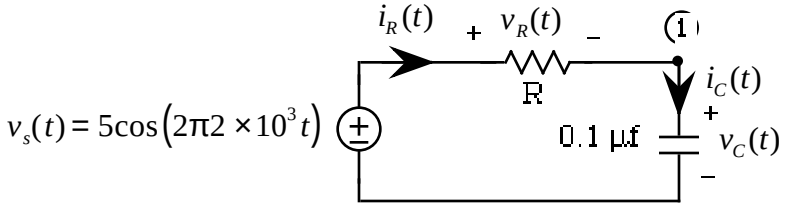
OBJECTIVE

The objectives of this lab are to measure the impedances of the resistor and capacitor and verify that the voltage and current phasors satisfy Kirchhoff's Laws in the following first order RC circuit



PARTNER 1: R = 1K PARTNER 2: R = 2K

LAB

1. **Prelab** - Obtain and measure your resistor and capacitor values. Then compare their nominal and measured values. Put your results in a Table

2. Build the circuit and make use of what you see on the scope obtain equations for $v_R(t)$ and $v_C(t)$

3. Make use of your results in Problem (2) to calculate the following currents for your measured values of R and C

$$i_R(t) = \frac{v_R(t)}{R} \quad \text{and} \quad i_C(t) = C\frac{dv_C(t)}{dt}$$

   Make sure both your currents are equal

4. Make use of your results in Problems (2) and (3) to obtain the voltage and current phasors $V_R\left(j2\pi 2 \times 10^3\right)$, $I_R\left(j2\pi 2 \times 10^3\right)$, $V_C\left(j2\pi 2 \times 10^3\right)$ and $I_C\left(j2\pi 2 \times 10^3\right)$

5. Make use of your voltage and current phasors in Problem (4) to calculate the resistor and capacitor impedances $Z_R\left(j2\pi 2 \times 10^3\right)$ and $Z_C\left(j2\pi 2 \times 10^3\right)$

6. Calculate the impedances from the derived equations

$$Z_R\left(j2\pi 2 \times 10^3\right) = R \quad \text{and} \quad Z_C\left(j2\pi 2 \times 10^3\right) = \frac{1}{j2\pi 2 \times 10^3 C}$$

7. Compare the measured and calculated values of the impedances - their magnitudes and phases - in Problems (5) and (6). Put your results in a Table

8. See how close the voltage phasors of your measured voltages come to satisfying Kirchhoff's Voltage Law around the closed loop as follows

$$V_S = V_R\left(j2\pi 2 \times 10^3\right) + V_C\left(j2\pi 2 \times 10^3\right)$$

   by comparing their real and imaginary parts. Put your results in a Table

9. See how close the phasors of the currents you calculated in Problem (3) come to satisfying Kirchhoff's Current Law at node 1 as follows

$$I_R\left(j2\pi 2\times 10^3\right) = I_C\left(j2\pi 2\times 10^3\right)$$

by comparing their real and imaginary parts. As always put your results in a Table

10. Verify that the magnitudes of the voltages don't satisfy Kirchhoff's Voltage Law around the closed loop of the circuit. Explain why not