

Finding an unknown resistance in series with a capacitor*

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An experiment has been set up for you. The arrangement is similar to what is provided in Experiment 1.6A. We have a resistor R in series with a capacitor C . The capacitor has a known capacitance. Measure it using the provided meters. A sinusoidal input of amplitude V_o , and frequency f , is applied and the voltage amplitudes across the resistor V_R are measured at various frequencies. The inputs and outputs are through a computer equipped with a data acquisition board. A Labview file is also provided and can be downloaded from the website.

The voltage across the resistor depends on the frequency through the relationship,

$$V_R = \frac{V_o R}{\sqrt{R^2 + \left(\frac{1}{2\pi f C}\right)^2}}. \quad (1)$$

Generate and analyze suitable data to measure the unknown resistance. At the end, remove the resistor from the circuit and measure the resistance with a provided meter. Do the results match?

You will receive credit for (a) tabulating data, (b) generating suitable variables, (c) plotting relationships between suitable variables, (d) inferring the resistance along with uncertainties and (e) comparing your estimates with a measurement from the meter. All of this, of course, should follow best practices we've learnt about inside the lab.

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