

Using phase relationships to find an unknown capacitance in an RC circuit

Mehran Rasheed and Muhammad Sabieh Anwar
Centre for Experimental Physics Education
LUMS Syed Babar Ali School of Science and Engineering

January 6, 2016
Version 2016-1

This task deals with the determination of an unknown capacitance inside an RC series circuit. You are provided with a Labview file (`rcphase.vi`) that communicates with a circuit already laid out for you on a breadboard. You can control the input frequency (preferably between 1 and 50 Hz) and will observe the sinusoidal voltages developed across the resistor R and the input voltage. These waveforms will be shifted in time through Δt . Hence there will be a phase difference $\phi = \omega\Delta t$ where $\omega = 2\pi f$, and f is the input frequency in Hz. The relation between the phase difference and the circuit parameters is

$$\phi = \tan^{-1} \left(\frac{-1}{2\pi f RC} \right). \quad (1)$$

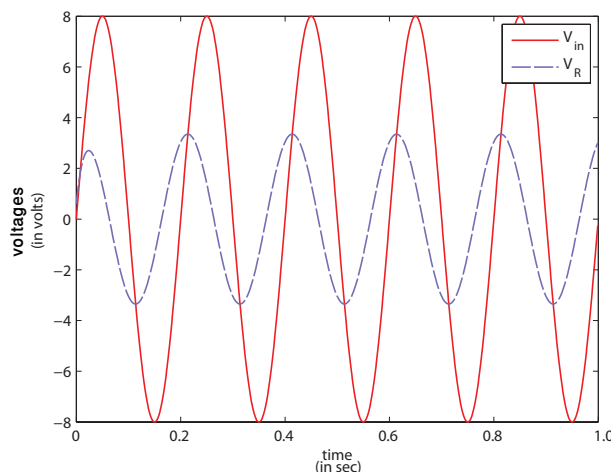


Figure 1: Sample plots showing relative phase mismatch between the input voltage and the voltage across the resistor.

Measure the resistance R by unplugging the variable resistor from the circuit and using an ohmmeter. Then start measurements. Use your experimental observations to determine the capacitance. We will like to see how you define your variables and what strategy you devise to find C . What's the uncertainty in C ? Last, perform an independent check on the capacitance with the help of the provided capacitance meter.