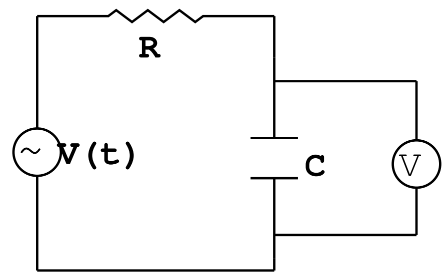
Impedance Problem 1

The circuit shown on the right contains a voltage source $V(t)$, a resistor R, and a capacitor C. The voltage source provides an oscillating voltage $V(t) = V_0 \cos(\omega t)$, which we assume has been on for a long time.By following the steps outlined below, calculate the time dependent voltage $V_R(t)$ measured by a voltmeter that is connected in parallel with the resistor.



- a) Write the voltage generated by the source as the real part of a complex exponential. Assume that it's amplitude, V_0 is real.
- b) Combine the complex impedances of the resistor and the capacitor to form the equivalent impedance of the entire circuit.
- c) Calculate the complex current amplitude for the circuit.
- d) Use the current amplitude you calculated in c) to find the complex voltage amplitude of the voltage drop, V_{0R}, across the resistor.
- e) Multiply the voltage amplitude by $e^{i\omega t}$ and take the real part to find $V_R(t)$.
- e) Assuming $V_0 = 10V$, $\omega = 1000 rad/s$, $R = 1000\Omega$, and $C = 2\mu$F, find the amplitude and phase shift of $V_R(t)$.
- f) Make a graph of the amplitude and phase shift of V_R vs ω.

Impedance Problem 2

A second cicuit is shown on the right. This time, there is an additional inductor that is wired in parallel to the capacitor. Assuming that V_0 and R are the same as in Problem 1, and that and $L = 0.25H$, calculate the voltage $V_R(t)$ measured across the resistor. What would the answer be if L were twice as large? Interpret your result in terms of the equivalent impedance of the parallel $L - C$ system.