

ECE 214 – Electrical Circuits Lab

Lecture 2

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Announcements

- Lecture canceled due to impending snowstorm
- Will attempt to briefly cover this material before each lab
- If a Lab is canceled due to snow you will have to make it up, either on Friday or during one of the other lab sections



Notes from Lab #1

- Explain Function Generator / Oscilloscope mismatch
- Don't use your fingers measuring resistors
- Rise time. 10 - 90%. Time constant 63%. These are related.



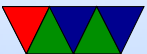
Lab #2 – First Order RC Circuits

- Investigate magnitude and phase shift from a RC circuit on a sinusoidal signal.



Pre-Lab

- Devise a test for the input resistance of your DVM (hint, think voltage dividers)
- Optionally same for capacitance
- Micro-cap simulation (see later)



Lab

- Actually measure the values of DVM



ESR of Capacitor

- Equivalent Series Resistance
- Capacitor is not perfect. ESR is the series resistor you'd have to put in series with the ideal capacitor value to match actual behavior.
- $ESR = \frac{D}{2\pi fC}$



Averaging Feature of the Scope

- Can press Display then Average and it will average the signal and make the values a bit more stable.



V and Phase Measurements

- Will need three probes (one to connect to function generator, two channels of measurements). We will loan out extra cables.
- Easiest way to measure phase difference is to plot both signals on top of each other. (auto-range. Then use the dials to put on top of each other. Then use the time cursor to find the difference between when the two signals cross the axis). Once you have Δt you can convert to phase by $360 \times \Delta t \times f$.



Lissajous

- To make Lissajous, press Autoscale then Main/Delayed then XY then use the position knob to center it.
- Can use to calculate phase angle. First use cursor to find delta Y (y_1) where cross Y axis. Then find delta Y (y_2) between max and min Y. Then $\sin\Theta = \frac{y_1}{y_2}$.



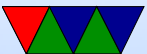
FFT

- FFT. See end of lab handout for doing this. Not all scopes support this?



Matlab

- Just using it for graphing
- More details in handout
- Can use octave instead
- Can use the campus supercomputer to get Matlab support, more difficult. I need to remember to link to the document describing how to do this.



Micro-Cap

- SPICE (Simulation Program with Integrated Circuit Emphasis)
- Can download free demo from their website (see the lab handout).
- Can use WINE to run this on OSX. Directions linked from handout. It does take some time to get this set up.
- There is a short example in the lab handout.



- Most of that applies to what is needed for the pre and post lab. The one extra thing you might need is how to setup for AC measurement. Add a Voltage source as in the example, but put $DC=0$ and $AC=5$. Choose Dynamic AC analysis. You can put in a comma separated list of the frequencies to analyze, then press start and then next to step through them all.

