# Central Connecticut State University
CET 346 Project
Frequency Response of a Circuit to an Arbitrary Periodic Signal

Objectives:

1. Determine the transfer function of a circuit with an operational amplifier
2. Generate a Bode plot for the circuit
3. Represent an arbitrary periodic signal as a function using Heaviside and other functions
4. Use Fourier series to break the signal into a series of sinusoidal functions
5. Perform circuit analysis on the individual sinusoids to predict the output of the circuit
6. Validate the result by simulating the circuit response.

Procedure:

1. Determine the transfer function of the circuit included in this handout. Use of MATLAB is not only permitted, it is encouraged.

2. Generate a Bode plot over a reasonable range of frequencies. (Label all axes, units, and remember to included both plots)

3. Examine the signal included in this handout to be used as the input (V_I) to the circuit. Represent the signal as a function of time. Plot your function and compare it to the desired signal.

4. Use Fourier series to determine the coefficients (a_k and b_k) for the signal. Find coefficients for k=0 to 200. Plot the two coefficients on the same plot against the frequency of each.

5. Estimate the original signal from a summation of sinusoids and plot it with your function found above. Use the same time domain as the one shown in this handout.

6. Use the transfer function you found earlier and/or additional circuit analysis to predict the output of the circuit to signal provided. Plot the input signal along with your predicted output using the same time domain as the one shown in this handout.

7. Construct the circuit in LTSpice and validate the Bode plot and circuit response to the given input
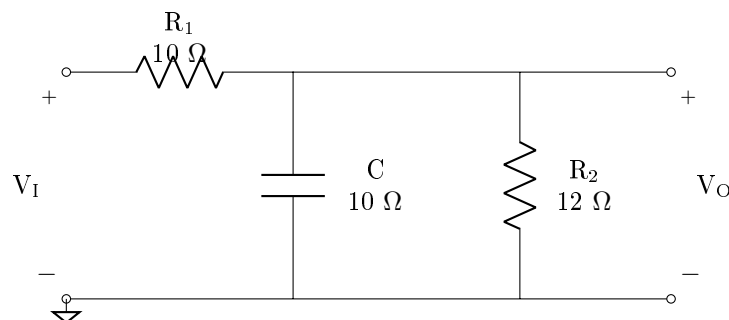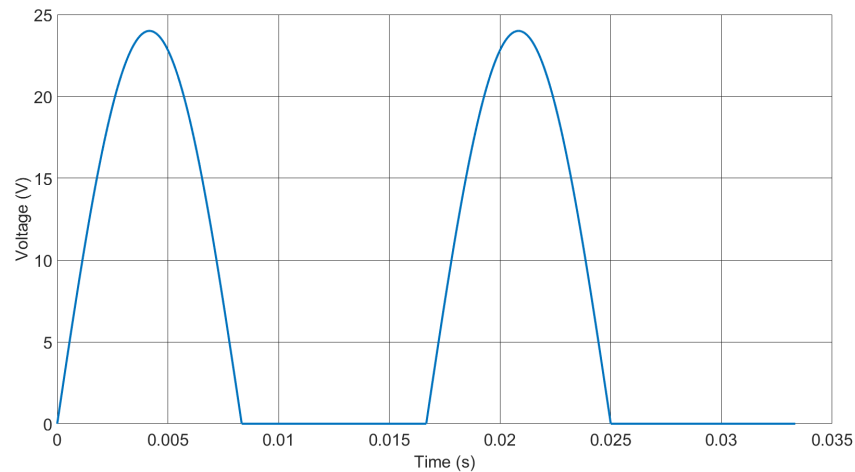
To turn in:

1. A clearly formatted transfer function for the included circuit

2. A bode plot for the included circuit

3. A clearly formatted function representing the included signal

4. A time-domain plot of the included signal generated with your own MATLAB code

5. A plot of Fourier coefficients for frequencies corresponding to k=0 to 200

6. Your original function for the included signal plotted with your estimated function using the results of the Fourier series.

7. Your predicted output of the circuit plotted with the input signal included in this handout

8. The simulated bode plot from LTSpice

9. The simulated circuit response from LTSpice

10. Any and all code you used in generating the plots or performing circuit analysis. Code should be clearly formatted and commented appropriately