ECE 321 - Homework #2

Active Filters, Poles, Zeros, & Frequency Response. Due Monday, April 9th, 2018

1) Assume X and Y are related by the following transfer function:

$$Y = \left(\frac{2000}{(s+5)(s+6)(s+7)}\right)X = \left(\frac{2000}{s^3+18s^2+107s+630}\right)$$

1a) What is the differential equation relating X and Y?

1b) Determine y(t) assuming

$$x(t) = 2 + 3\cos(10t)$$

1c) Plot the gain vs. frequency for this filter from 0 < w < 20 rad/sec

1d) Design an op-amp circuit to impliment this filter.

2) Assume X and Y are related by the following transfer function:

$$Y = \left(\frac{2000}{(s+10)(s+5+j8.67)(s+5-j8.67)}\right)X = \left(\frac{2000}{s^3+20s^2+200s+1000}\right)X$$

2a) What is the differential equation relating X and Y?

2b) Determine y(t) assuming

$$x(t) = 2 + 3\cos(10t)$$

2c) Plot the gain vs. frequency for this filter from 0 < w < 20 rad/sec

2d) Design an op-amp circuit to impliment this filter.

3) Assume X and Y are related by the following transfer function:

$$Y = \left(\frac{4s}{(s+2+j9.8)(s+2-j9.8)}\right)X = \left(\frac{4s}{s^2+4s+100}\right)X$$

3a) What is the differential equation relating X and Y?

3b) Determine y(t) assuming

$$x(t) = 2 + 3\cos(10t)$$

3c) Plot the gain vs. frequency for this filter from 0 < w < 20 rad/sec

3d) Design an op-amp circuit to impliment this filter.

4) Lab: Build a push-pull amplifier to meet the following requirements:

- Input: +/- 10V signal capable of driving 10mA (1 k Ohm)
- Output: 8 Ohm speaker
- Relationship: Y = X +/- 0.5 Volts from DC to 10kHz.

Collect data to verify your push-pull amplifier is working (save your circuit - we'll use it next week)