

ECE 321 - Homework #2

Integrators, Differentiators, Filters and Phasors. Due Monday, April 11th

- 1) Design an op-amp circuit to implement a PID compensator:

$$Y = \left(3 + \frac{4}{s} + 5s \right) X$$

Problem 2-5) A filter has the following transfer function

$$Y = \left(\frac{100}{(s+8.5)(s+12.1\angle 69.5^\circ)(s+12.1\angle -69.5^\circ)} \right) X$$

- 2) What is the differential equation relating X and Y?
3) Determine $y(t)$ assuming

$$x(t) = 2 + 3 \cos(4t) + 5 \cos(400t)$$

- 4) Plot the gain of this filter from 0 to 100 rad/sec
5) Design a circuit to implement this filter

6a) Design a filter which

- Has a gain between 0.9 and 1.1 at 10 rad/sec
- Has a gain less than 0.1 at 1 rad/sec, and
- Has a gain less than 0.1 at 100 rad/sec

6b) Verify your filter in Matlab

Lab:

7) Design a push-pull amplifier to drive an 8-Ohm speaker

- Input: -5V to +5V, capable of 10mA, 0 - 10kHz
- Output: 8 Ohm speaker
- Relationship: $V_o = V_{in}$, +/- 500mV

8) Build a circuit to implement this push-pull amplifier. Verify its operation at

- $V_{in} = -4V$
- $V_{in} = -2V$
- $V_{in} = +2V$
- $V_{in} = +4V$