# Prelab 5 \_\_\_/40

## (A). Finding K and τ for the motor transfer function \_\_/8

Use the results from the lab 4 to determine the time constant and gain K in the motor transfer function



*Hint: Here*  *is the output of the Amplifier. (i.e. e2­\*KAMP). Use the 1st order transfer function that ignores the effect of inductance from Prelab 4.*

## (B). Compute the closed-loop pole locations for the three sets of gains of P1 and P2 \_\_/6

|  |  |  |  |
| --- | --- | --- | --- |
| P1 | 0.15 | 0.25 | 0.1 |
| P2 | 0 | 0.35 | 0.5 |
| Poles |  |  |  |

## (C). Find P1 and P2 such that:

## Mp is approx 15%

## tr is approx 0.030s. \_\_/8

*Hint: Find the required ωn and ς first. Then, since ωn and ς are functions of P1 and P2, find the required gains.*

## (D). Show the 2 root locus plots for your P1 and P2 values. Show that it meets the requirements \_\_/10

Hint: You may use the command rlocus(), in Matlab, which accepts a transfer function. You will have to rewrite the denominator of your closed-loop transfer function so that the required gain (P­1 or P2) is the K value. We can only vary one at a time, so set the other to the value found in C. Page 223, FPE, (or page 233 in the 5th edition) shows how to rewrite the equation. Each form (1)-(4) has the same roots, but rlocus() expects *L(s)* as in (1).



Attach your root locus plots for P1 and P2. If you click on the plot in Matlab, it will tell you the K value, as well as the damping (ζ) and frequency (ωn). Find the spot on the curve that gives the ζ and ωn you calculated from part C. Compare the K value you get to part C.

## (E). Draw a patch-panel wiring diagram \_\_/8

Remember to tie the output of each unused op-amp back into one of its input resistors. This will cause negative feedback and thereby reduce any random noise in the analog computer. (This is less necessary when the circuit has no integrators)

You may use this jpg image for your wiring diagram. (I used paint to draw in the wires)

There is also a *Microsoft Visio* template on the lab website.

# blank_analog_computer