EE 105 Lecture 9 worksheet
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1 Examining a system

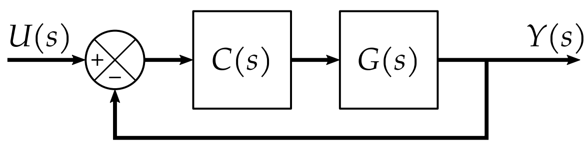
Given a system,

$$G(s) = \frac{1}{s^2 + 20s + 2}$$

1. Use Matlab to plot the step response.
2. What are the poles of this system?

2 Applying proportional control

1. Now apply proportional feedback ($C(s) = k_P$), and compute the overall transfer function $H(s)$:



2. Use Matlab to plot the poles of the complete system as a function of the proportional gain, as k_P goes from 0 to ∞ (or at least some reasonable limits for the plot).
3. Draw a line on your graph where the damping ratio is $\zeta = 0.5$. What value of k_p produces $\zeta = 0.5$?
4. Is there a value of k_p that makes the system unstable?

3 Applying integral control

1. Now apply integral feedback ($C(s) = k_i/s$), and compute the overall transfer function $H(s)$.
2. Plot the poles for some reasonable range of k_i. What happens?

4 Exploring further

1. What about proportional-derivative control? Recall that $C(s) = k_P + k_D s$. Since you can only plot one gain parameter, make this k_D and use a constant ratio of k_P/k_D.
2. What about the transfer function
$$G(s) = \frac{1}{s^2 + 2s - 20}$$
3. Try other transfer functions - can you pick gain values that cause the system to become unstable? Values which make an unstable system stable? What about PID control?