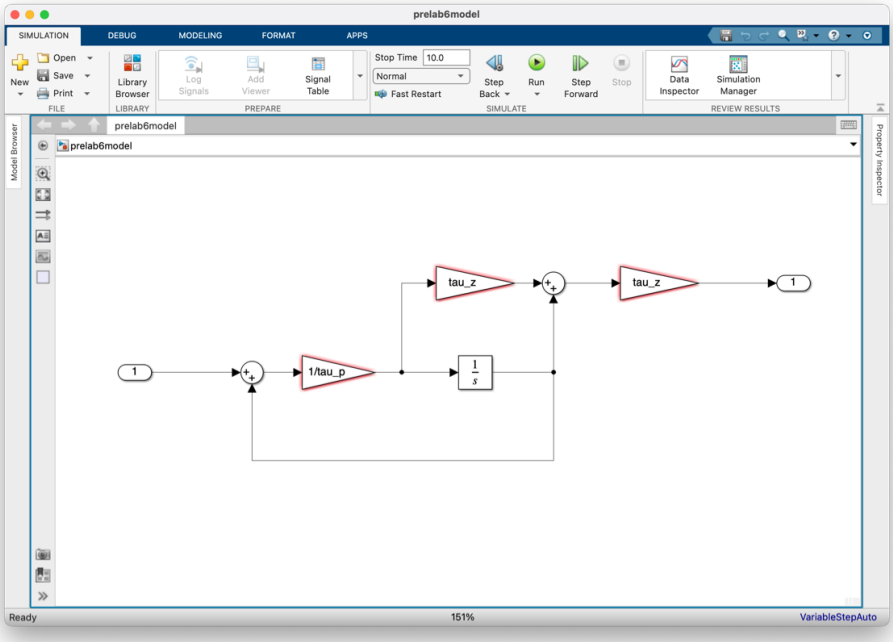
prelab6 ece486

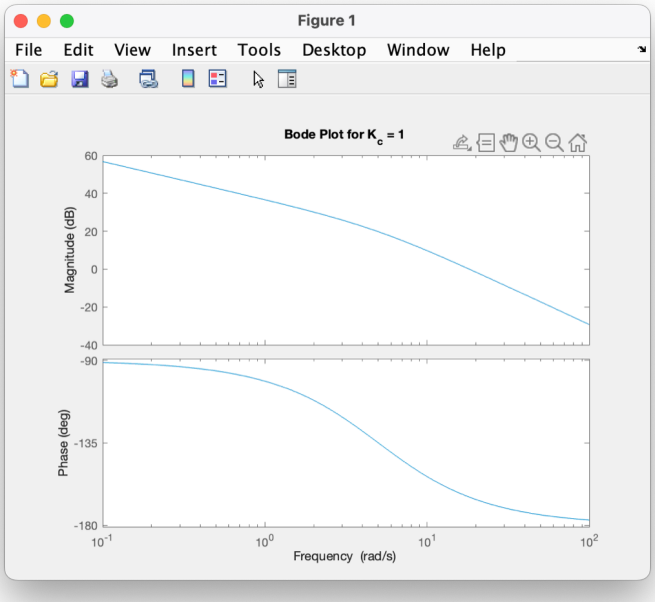
a

the all-integrator block diagram

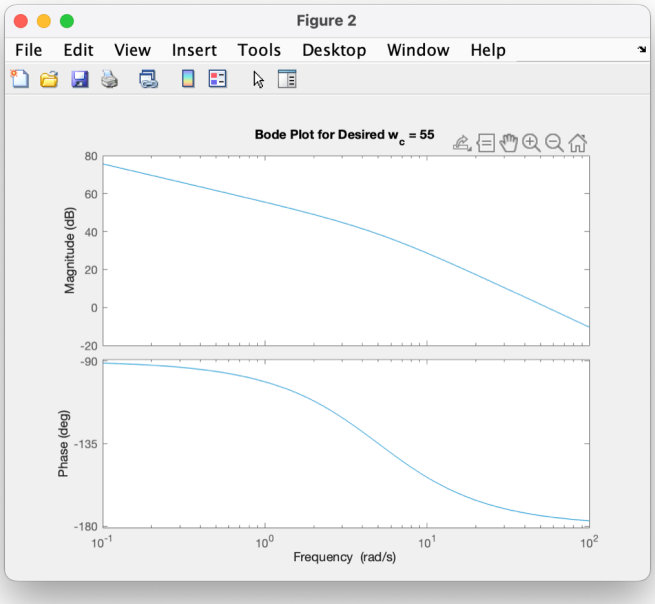


b

When $k_c = 1$, the ω_c is 18.207028 and phase margin is 15.355966.

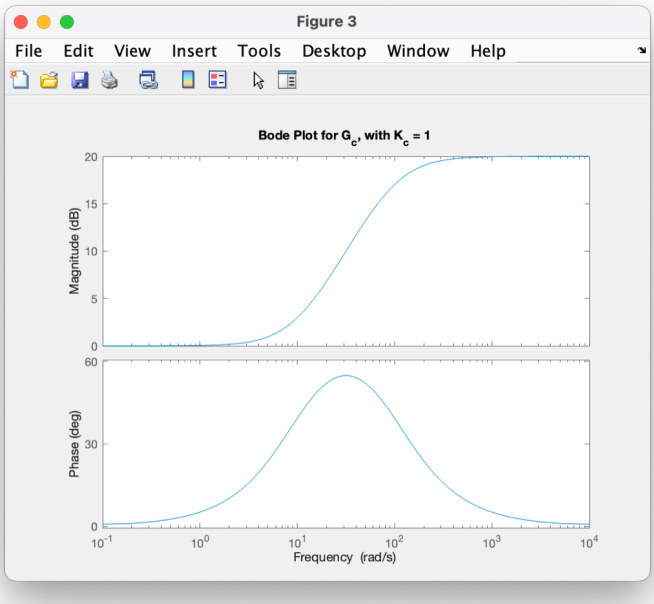


To get $\omega_n = 55$, we need $k_c = 8.833873$



As I increase k_c, I notice a decrease in the phase margin.

c



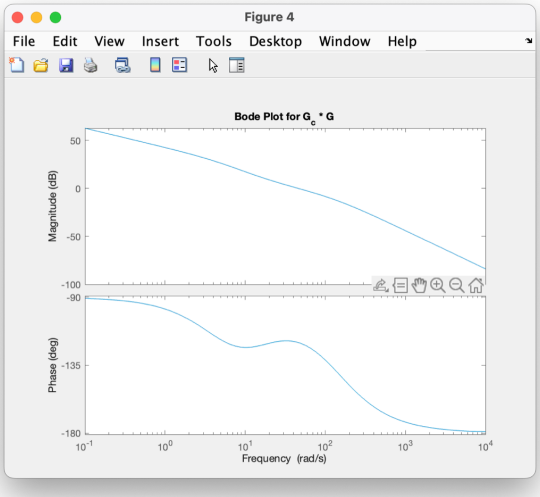
d

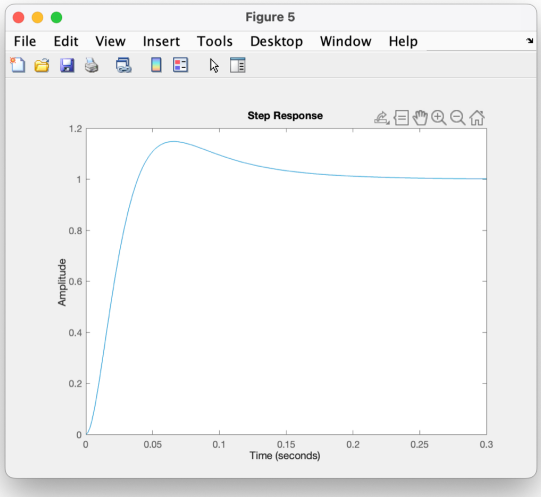
according to $M_p = exp\left(-\frac{\pi\zeta}{\sqrt{1-\zeta^2}}\right)$, we get $\zeta = 0.5169$

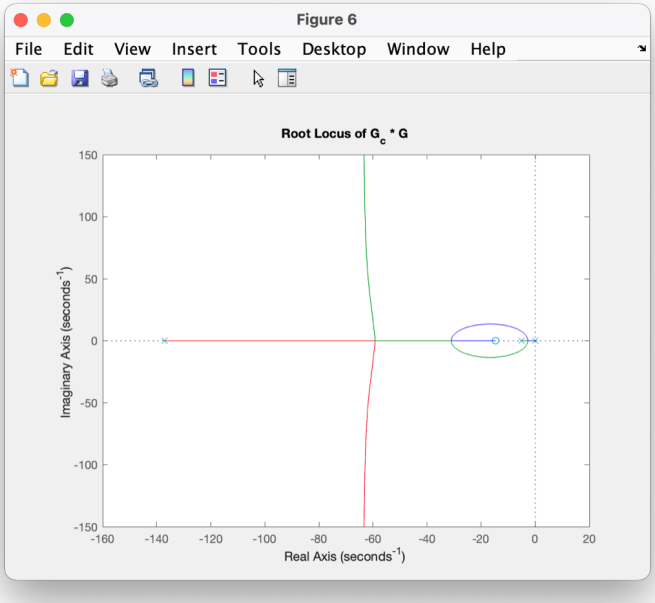
according to $t_r = \frac{1.2-0.45\zeta+2.6\zeta^2}{\omega_n}$, we get $\omega_n = 55.4049$

$G(s) = \frac{3069.702944}{s^2+57.277586*s}$, in which phase margin is 42.9 and crossover frequency is 53.16

I set τ_z to 0.07, τ_p to 0.007, and k_c to 2. And I get phase margin 59.880085, crossover frequency 46.218518, rise time 0.026540, and overshoot 14.779513%.







e

It meets both the bandwidth and the phase margin requirement. But it doesn't meet the overshoot and rise time requirement. The rise time is 0.014917 but the overshoot is 18.292193%.