Programming Exercise
Run Bode … RUN

Objective of this exercise is to help you develop an in-depth understanding of bode plots, and understand the practical implications of utilizing these plots.

Perform all the programming steps in a single file named **<roll_number>_P1.m** and submit that, along with a PDF of the written components.

Consider the following 2 transfer functions C(s) and G(s)

$$C(s) = \frac{s+a}{s+b} \qquad G(s) = \frac{8}{s^2+s+8}$$

1. Bode Plots:
    a. Write a MATLAB function to generate the bode plots of the system G(S) along with the asymptotes if the numerator and denominator were provided to the function as input vectors (just as they are provided in the function *tf*).

    b. Use the inbuilt MATLAB function *bode* to generate the bode plots of the function and compare with the output of your function.

    c. Generate the response of the function G(s) to an input sinusoid of the form *sin ωt,* for a frequency of 0.25 rad/s, 2.5 rad/sec, 25 rad/sec and 250 rad/sec. Verify if the results match the results predicted by the bode plots of G(s).

2. Develop a lag controller C(s) with a pole at -0.1 and a zero at -0.5. For C(s) and G(s) in the forward path and a negative unitary feedback, generate the bode plots of the open loop transfer function and the closed loop transfer function with the inbuilt *bode* command.

    a. What is the effect of the addition of C(s) on the frequency response of G(s)?
    b. How does closing the loop affect the frequency response of C(s)G(s)?
    c. What can you infer about the steady state error of the closed loop system?