

Control Systems LAB Digital Assignment 3

Submitted by:

Swarup Tripathy — 19BEE0167



School of Electrical Engineering

Faculty: Professor Dhanamjayalu C

Course: EEE-3001

Course Name: Control Systems Lab

Lab Slot: L45 + L46

Stability Determination of a System by Bode Plot

Exp No: 3

Date: 02-02-2022

AIM

1. To analyze the stability of the system given in transfer function model by Bode Plot using M-file Editor in MATLAB.

APPARATUS REQUIRED

1. Personal Computer with MATLAB

THEORY

1. The bode plot is a frequency response plot of the transfer function of a system. A bode plot consists of two graphs. One is plot of the magnitude of a sinusoidal transfer function versus log . The other is plot of the phase angle of a sinusoidal transfer function versus log . The main advantage of the bode plot is that multiplication of magnitude can be converted into addition. Also a simple method for sketching an approximate log magnitude curve is available.

PROCEDURE

1. Enter the command window of the MATLAB.
2. Create a new M – file by selecting File – New – M – File.
3. Type and save the program.
4. Execute the program by either pressing F5 or Debug – Run.
5. View the results.
6. Analysis the stability of the system.

PROBLEM STATEMENT

1. Write a program in MATLAB to obtain a Bode plot for the transfer Function

$$(a) \ G(s) = \frac{15}{s(s+3)(0.7s+5)}$$

$$(b) \ G(s) = \frac{(7s^3+15s^2+7s+80)}{(s^4+8s^3+12s^2+70s+110)}$$

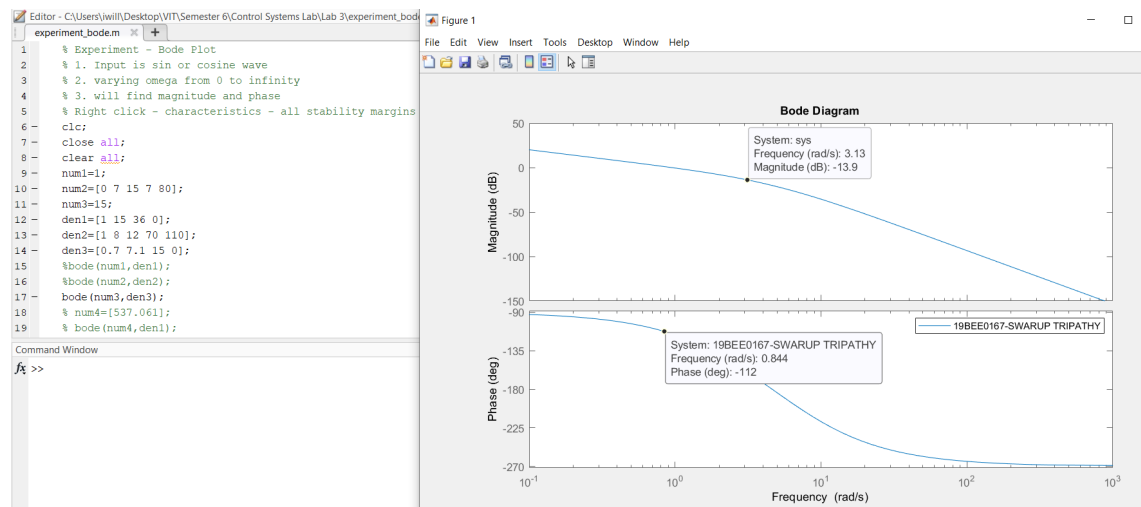
- Write a program in MATLAB for the unity feedback system with so that the value of gain K can be input.

$$G(s) = \frac{k}{s(s+3)(s+12)}$$

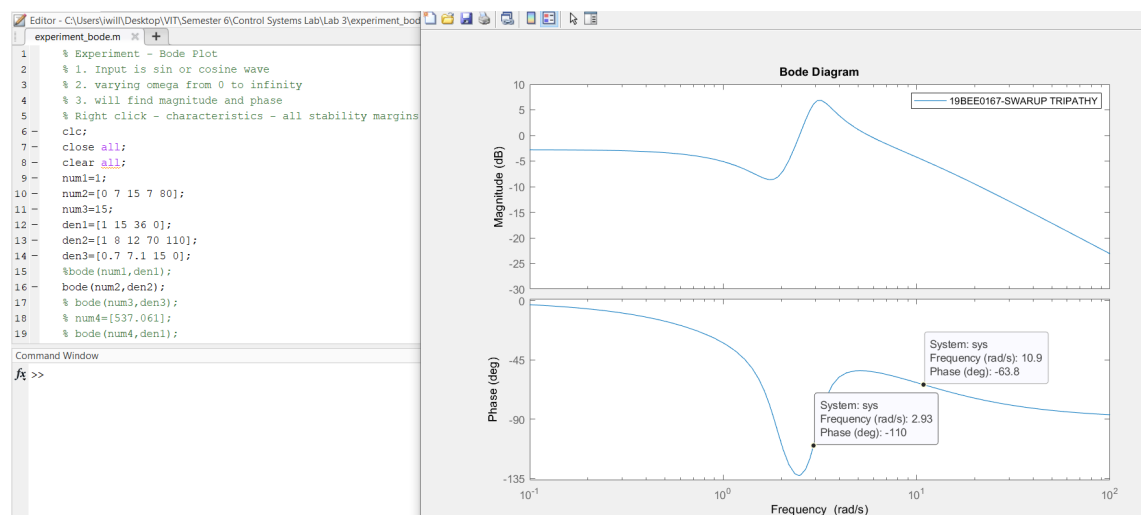
Display the Bode plots of a system for the input value of K. Determine and display the gain and phase margin for the input value of K.

SYSTEM RESPONSE

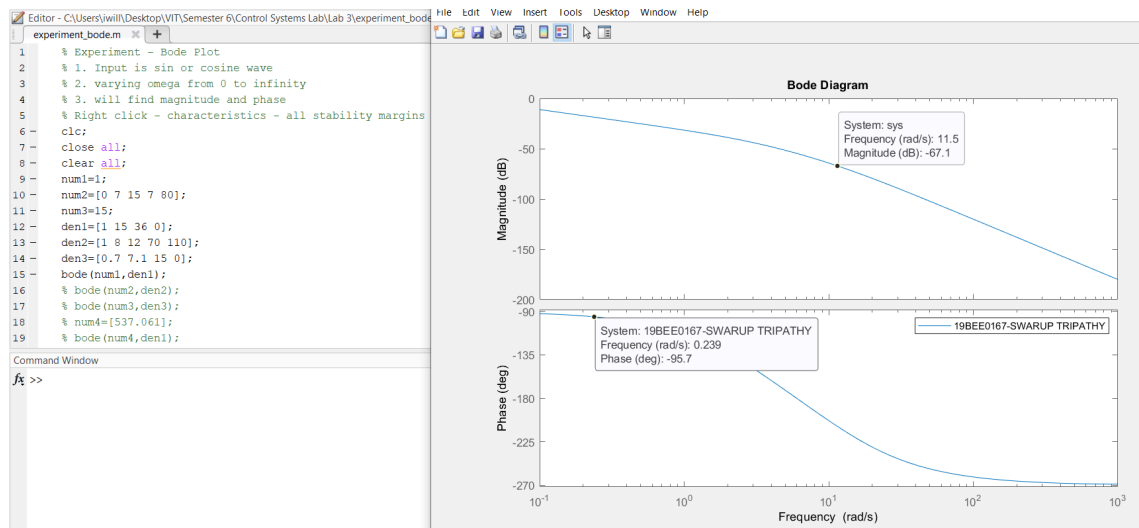
- Response for Code 1



- Response for Code 2



- Response for Code 3



POSSIBLE INFERENCES

1. Bode Plot can be obtained by the transfer function using conventional method by analyzing the corner frequency of poles and zeros and calculating various parameters such as magnitude, phase angle, slope and calculating gain crossover and phase crossover frequency by plotting the curves and this method can be used for simple or moderately complex system.
2. But for a highly complex system it becomes difficult to calculate all the parameters and make the analysis difficult.
3. Thus, software such as MATLAB can be used to get the bode plot of any transfer function within seconds just by writing a simple program using inbuilt commands in it making calculations easier and fast.
4. The gain and phase margin for this transfer function were calculated and the graphs were obtained accordingly.