ANKARA UNIVERSITY
Engineering Faculty
Departmant of Electrical and Electronics Engineering

Experiment-7

EEE 360 Control Lab

FREQUENCY RESPONSE METHODS

Objectives of the Experiment:

-Learn basics of LabVIEW and frequency response methods

-Understand the connection between frequency response and performance specifications in time domain.

-Learn the Simulation window and related topics of LabVIEW

1.Preliminary Study:

1.Please read experimental study section to understand what you are going to do in the experiment.
2.Research on related topics in computer programs like Matlab or Scilab. Prepare yourself for the next questions and experiment. Learn and read related documents to understand the experiment.
3. Consider the closed-loop transfer function

$$T(s) = \frac{30}{s^2 + s + 30}.$$

Develop an m-file to, obtain the Bode plot and verify that the resonant frequency is 5.44 rad/s and that the peak magnitude Mpw is 14.8 dB.
4. For the following transfer functions, sketch the Bode plots, then verify with the bode function:

(a) $G(s) = \frac{2000}{(s + 10)(s + 200)}$

(b) $G(s) = \frac{s + 100}{(s + 2)(s + 30)}$

(c) $G(s) = \frac{200}{s^2 + 2s + 100}$

(d) $G(s) = \frac{s - 5}{(s + 3)(s^2 + 12s + 50)}$

5. For each of the following transfer functions, sketch the Bode plot and determine the crossover frequency in Matlab (or Scilab):

(a) $G(s) = \frac{2500}{(s + 10)(s + 100)}$

(b) $G(s) = \frac{50}{(s + 1)(s^2 + 10s + 2)}$

(c) $G(s) = \frac{30(s + 100)}{(s + 1)(s + 30)}$

(d) $G(s) = \frac{100(s^2 + 14s + 50)}{(s + 1)(s + 2)(s + 200)}$

2.Experimental Study:

This section is given in two parts. The application in the first part (Repeat the Steps) is expected to be repeated by the student and to find the same result obtained. Thus, the student understands the subject and learns how to use it. In the second part (Do it Yourself), the jobs to be done are

listed, but they are not explained how to do them. He solves and fills in the datasheet using the information (s)he learned in the first part and what he did in the preliminary study.

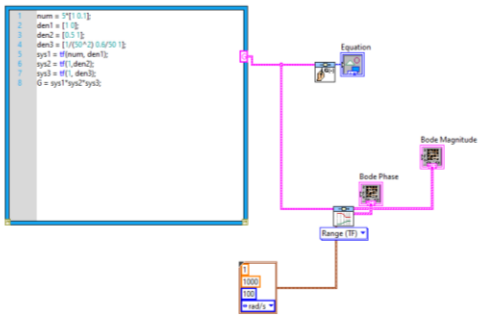
Look at the previous experiment's documents. Be sure you learn every step at the previous experiments. You may need the information from the previous experiment.

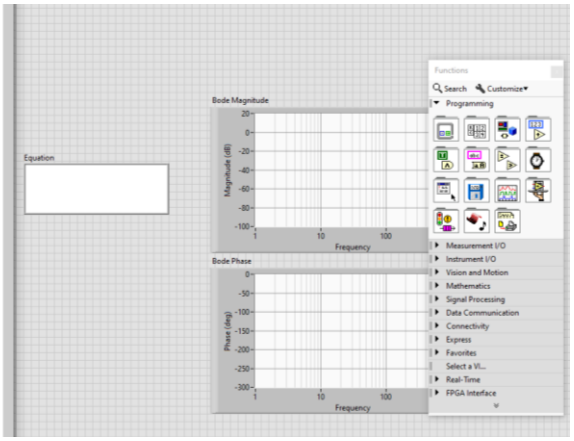
2.1. Repeat the Steps

Consider the transfer function

$$G(s) = \frac{5(1+0.1s)}{s(1+0.5s)(1+\frac{0.6}{50}s+\frac{1}{50^2}s^2)}.$$

The Bode plot corresponding to Eq. is shown in Fig.





2.2. Do it Yourself!

1. Obtain Bode plots in LabVIEW for questions in preliminary work questions 4 and 5.

Report:

1.Please answer all the questions give in experimental study. Please use Data Sheet you obtained from the experiment.

2.Make the analytical calculations in preliminary study questions 3,4 and 5.

3.Compare the asymptotical Bode diagram and real Bode plot. What are the differences?

4.What is the crossover frequency? Why it is important?