

Experiment #5

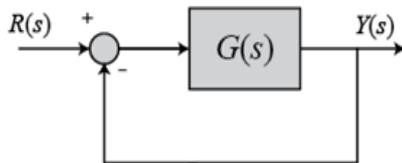
Frequency Domain Analysis of Systems Using the Program MATLAB

1. Preliminary Work

- 1.1 Give a brief description of the gain margin and the phase margin. Give some sample bode plot drawings to explain the two concepts.
- 1.2 Give definitions of the cut-off frequency and the bandwidth. Give drawings to explain the two concepts.
- 1.3 In the calculation of the gain and phase margins, do we use the open-loop or the closed-loop transfer function?
- 1.4 In the calculation of the cut-off frequency and the bandwidth, do we use the open-loop or the closed-loop transfer function?

2. Experimental Work

The following stages will be carried out using the program MATLAB. Consider the system in the figure where the transfer function:



$$G(s) = K/s(s+0.1)(s+5)$$

2.1. Consider $K=10$.

- 2.1.1. Using the facilities of the program, obtain the bode plot for both gain and phase of $G(s)$. Sketch or print this plot on your notebook. Calculate the phase and gain margin using the plot.
- 2.1.2. Obtain the frequency plot (bode plot) for the closed loop system. Sketch or print this plot on a sheet of paper. Calculate the cut-off frequency and the bandwidth using the plot.

2.2. Let $K=100$.

- 2.2.1. Repeat 2.1.1 for this case.
- 2.2.2. Repeat 2.1.1 for this case.

3. Results and Conclusions

- 3.1. Compare the results you have obtained for $K=10$ and $K=100$.
- 3.2. Comment on the stability of the system in the figure for two values of K .
- 3.3. Summarize the conclusions derived resulting from the experiment.