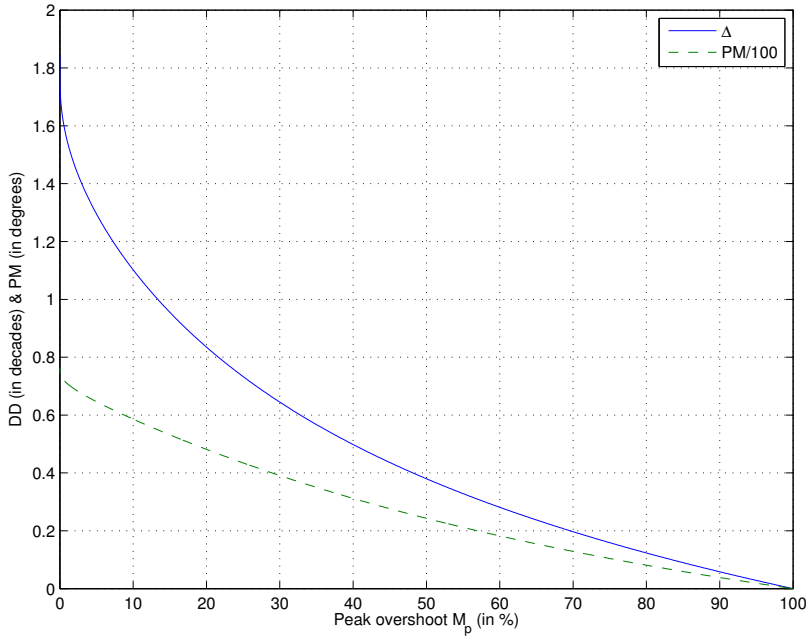
GNU Octave quiz, EE250, Spring 2012*

DEPARTMENT OF ELECTRICAL ENGINEERING, IIT KANPUR

Student's Name: **Roll No.:** **Section:**



Item	mark
ABMP meets Spec.1 (PM)	
ABMP meets Spec.2 (LF)	
ABMP meets Spec.3 (HF)	
ABMP meets Spec.4 (t_s)	
Spec.1 satisfied by `yourname_rollNo_PM.png`	
Spec.2 satisfied by `yourname_rollNo_sin1.png`	
Spec.3 satisfied by `yourname_rollNo_sin200.png`	
Spec.4 satisfied by `yourname_rollNo_ts.png`	
`yourname_rollNo_simul1.m` is correct	
`yourname_rollNo_simul2.m` is correct	

Instructions

1. Use a ruler or some straight edge for your ABMPs.
2. Your final answers should use ink. Answers that are written using pencil will be ignored.
3. Do not overwrite. To change an answer, strike it out, and write the correct version near it.
4. The Bode plots on the semilog grid provided must be labeled fully.
5. Do not write into the above table.

Specifications

For a plant with the transfer function (TF) $\frac{\omega(s)}{V(s)} = \frac{10}{s+10}$ design using the loop-shaping technique demonstrated in our lectures a unity feedback controller of minimum order that satisfies the following specifications:

1. Phase margin of $55^\circ \pm 2^\circ$.
2. Sinusoidal inputs of up to 1 rad/sec to be reproduced with $\leq 1\%$ error.
3. Sinusoidal inputs with a frequency of greater than 200 rad/sec to be attenuated at the output to $\leq 5\%$ of their input value.
4. A settling time of (0.4 ± 0.05) s into a 2% tube.

Problems for the semilog grid

1. Draw neatly on the above semilog grid
   1.1. the asymptotic Bode magnitude plot (ABMP) of the plant, and the forbidden zones.
   1.2. the desired open-loop (OL) ABMP that would most likely satisfy the above spec-s.
   The desired ABMP needs to show how the above 4 spec-s are satisfied. In our grading, we will not look at any calculations you may have performed. We will only read the values off your ABMP.
2. Write the transfer function of the controller in the bottom left hand corner of the semilog grid.

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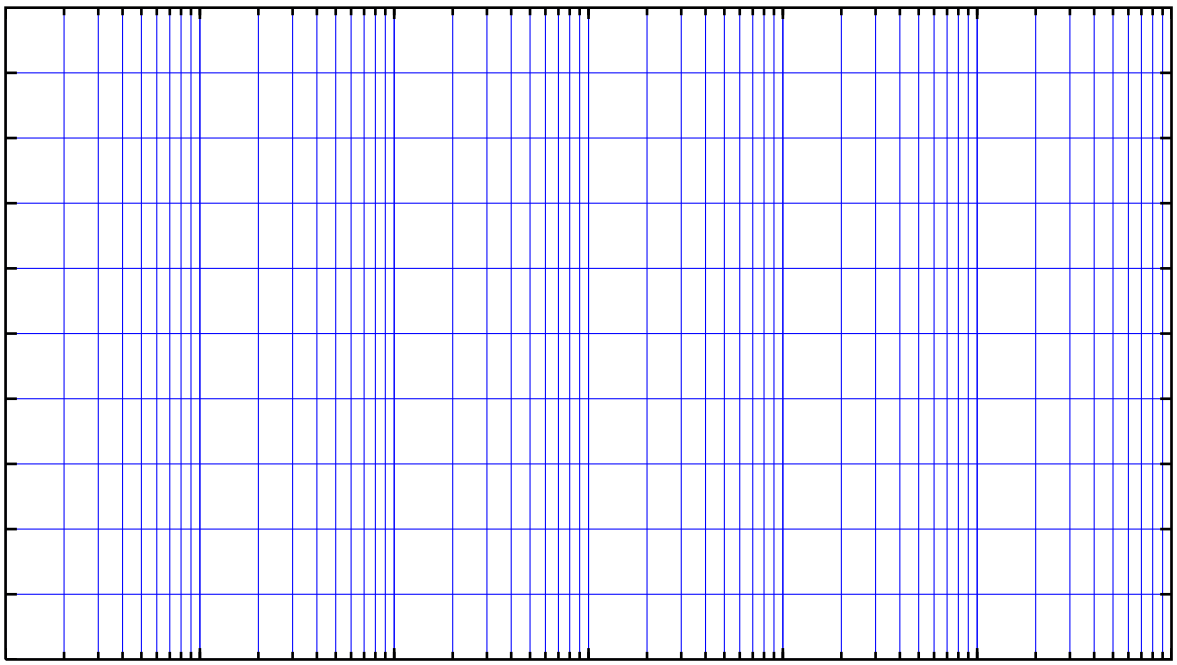

GNU Octave problems

Using GNU Octave, tweak, through trial and error, the above-designed OL ABMP, and consequently, the controller, such that above specifications are satisfied. Then,

1. Print to the file named `yourname_rollNo_PM.png` the appropriate Bode plot so that we may read the phase margin.
2. Print to the file named `yourname_rollNo_sin1.png` (i) a sinusoid of frequency 1 rad/s and magnitude 1, and (ii) the response of the closed-loop system to this sinusoid.
   For this task and for the following one, you will necessarily use the file named `simul.m` provided to you in advance, that you have modified to work in GNU Octave, and that you have stored in your e-mail box to be downloaded to your computer at 10 AM of April 14, 2012. Make 2 versions of this file named `yourname_rollNo_simul1.m` and `yourname_rollNo_simul2.m`. The first file can be used to generate `yourname_rollNo_sin1.png` and the second file can be used to generate `yourname_rollNo_sin200.png` that is seen next.
3. Print to the file named `yourname_rollNo_sin200.png` (i) a sinusoid of frequency 200 rad/s and magnitude 1, and (ii) the response of the closed-loop system to this sinusoid.
4. Print to the file named `yourname_rollNo_ts.png` the appropriate unit step response so that we may read the settling time.

What you will give us

1. Save the 6 files generated above in a folder named `yourname_rollNo_octave`. Compress this folder into `yourname_rollNo_octave.zip`, and e-mail it to `anilapj@iitk.ac.in` if you are in Sec. 1, `dorai@iitk.ac.in` if you are in Sec. 2, `anusoni@iitk.ac.in` if you are in Sec. 3, and `vmahesh@iitk.ac.in` if you are in Sec. 4. **CC your mail to** `potluri@iitk.ac.in`. The subject line of your mail will read `EE250-2012: Octave quiz, Your Name, Your ROLL NO., Your SEC. NO.`
2. Turn in this paper.

Finally

Below, write the $G_{\text{des}}(s)$ and TF of the controller and that have emerged from the above GNU Octave-based tweaking.