

# Quiz # 3, EE250 (Control System Analysis), Spring 2012\*

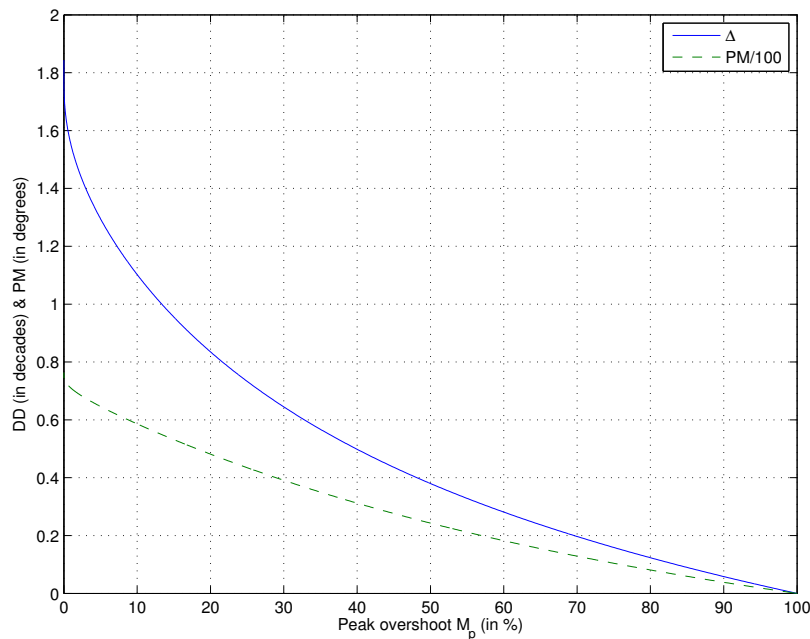
DEPARTMENT OF ELECTRICAL ENGINEERING, IIT KANPUR

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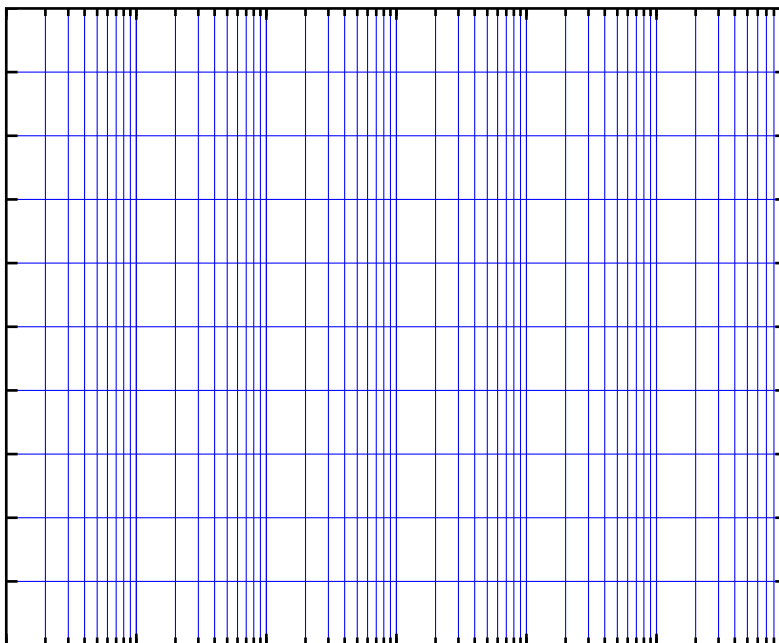
A Bode plot is considered completely labeled if it contains the following information: (1) Quantity assigned to each axis, and the units in which it is expressed, (2) the slopes of the various sections, and (3) the values of the corner frequencies.



For a permanent magnet dc (PMDC) motor with the transfer function

$$\frac{\omega(s)}{V(s)} = \frac{20}{s+1}$$

design using the loop-shaping technique demonstrated in our lectures a unity feedback controller of minimum order that provides a phase margin of about 30%, and so that the closed loop system has a steady-state error to unit step of less than 2% and a settling time of about 10 ms. Assume  $\omega_g = \omega_B$ .



Your solution needs to contain the following parts:

1. A calculation that shows how you will satisfy each of the above 3 specifications.
2. The asymptotic Bode magnitude plot (ABMP) of the plant.
3. The desired open-loop ABMP.
4. The transfer function of the controller.

Use a ruler or some other straight edge for your ABMPs. Your final answers should use ink.

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