

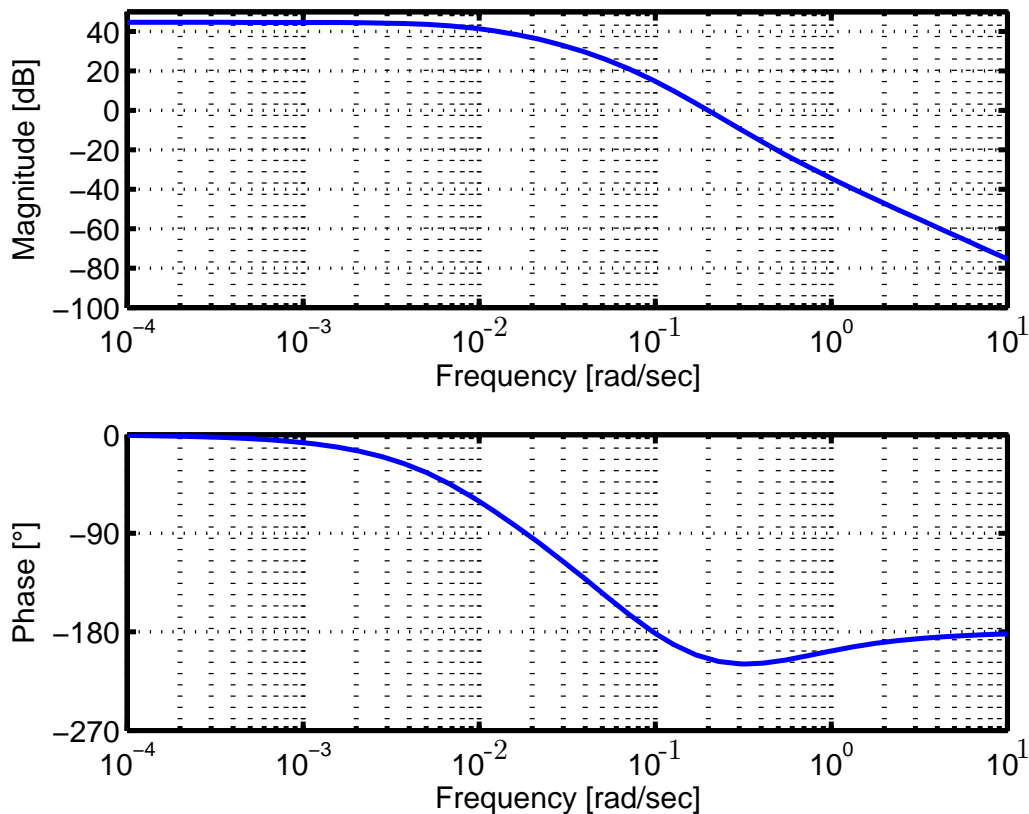
Laboratory 11: Stability

Problem 24:

- a. Recall from Problem 22 that $G_{o1} \rightarrow$ (b), $G_{o2} \rightarrow$ (c) and $G_{o3} \rightarrow$ (a). Determine for which of these open-loop transfer functions you get a stable feedback loop.
- b. Verify your result in **a.** by simulation.

Problem 25:

Assume we are given an open-loop transfer function $G_o(s) = K G(s)$. The bode plot of $G(s)$ is shown in the following figure.



- a. Sketch the Nyquist plot of $G_o(s)$ for $K = 1$.

We now investigate the basic feedback loop with the controller $C(s) = K$ (constant) and the plant transfer function $G(s)$ with the bode plot in the previous figure.

- b. Sketch the basic feedback control loop
- c. Use the bode plot and the Nyquist plot in **a.** to show that the basic feedback loop is unstable for $K = 1$?
- d. How should we choose K such that stability is achieved?
- e. Determine K for a phase margin of $\Phi_m = 45^\circ$
- f. Simulate a reference step response of the feedback loop for the controllers in **c.** and **e.**
Hint: Use the plant transfer function on the course webpage.