## Homework 10: Stability Margins and Lead Compensator

Note: This homework assignment is due on Thursday 10.05.2012, 15:40.

Problem 22:

We consider the basic feedback control loop with the open-loop transfer function $G_o(s) = \dfrac{0.1}{s(1 + 10s)(1 + 2s)}$. Sketch the bode plot of $G_o(s)$ and estimate the gain margin, gain crossover frequency, phase margin and phase crossover frequency for $G_o(s)$. You can use the bode plot template on the back page.

Problem 23:

Assume we are given the basic feedback loop with a controller $C(s) = K$ (constant) and a plant transfer function $G(s)$ whose bode plot is shown in the following figure.
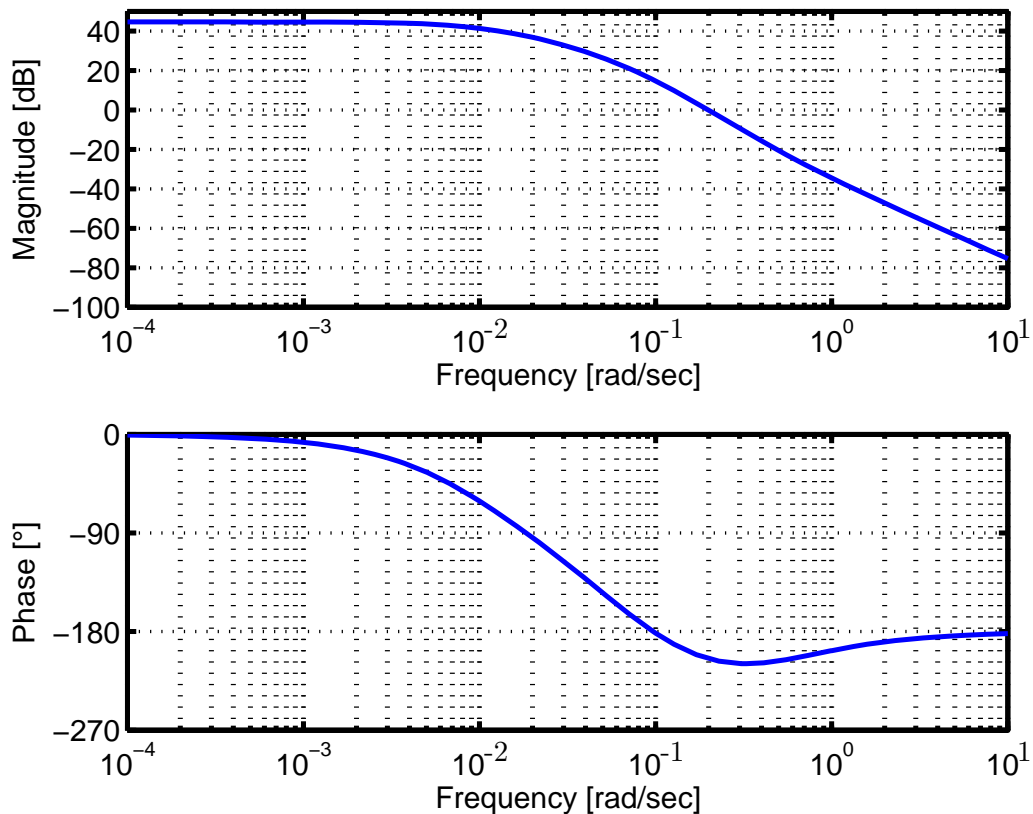
a. Why is the basic feedback loop instable for $K = 1$?

b. How should we choose K such that stability is achieved?

c. Determine K for a phase margin of $\Phi_m = 45°$

d. Now design a lead compensator such that the static position error is approximately 0.0063 and the phase margin is $\Phi_m = 45°$. What is the advantage compared to **c.**?