

Emne E0404 Prosjekt: Reguleringsystem. Øving 4

Exercise 0.1 *Stability analysis of a transfer function*

Determine the stability property of the following transfer function:

$$H(z) = \frac{1}{z^2 - 0.25} \quad (1)$$

Exercise 0.2 *Stability analysis in a Bode diagram*

Figure 1 shows the Bode curves of the loop transfer function of a given control system.

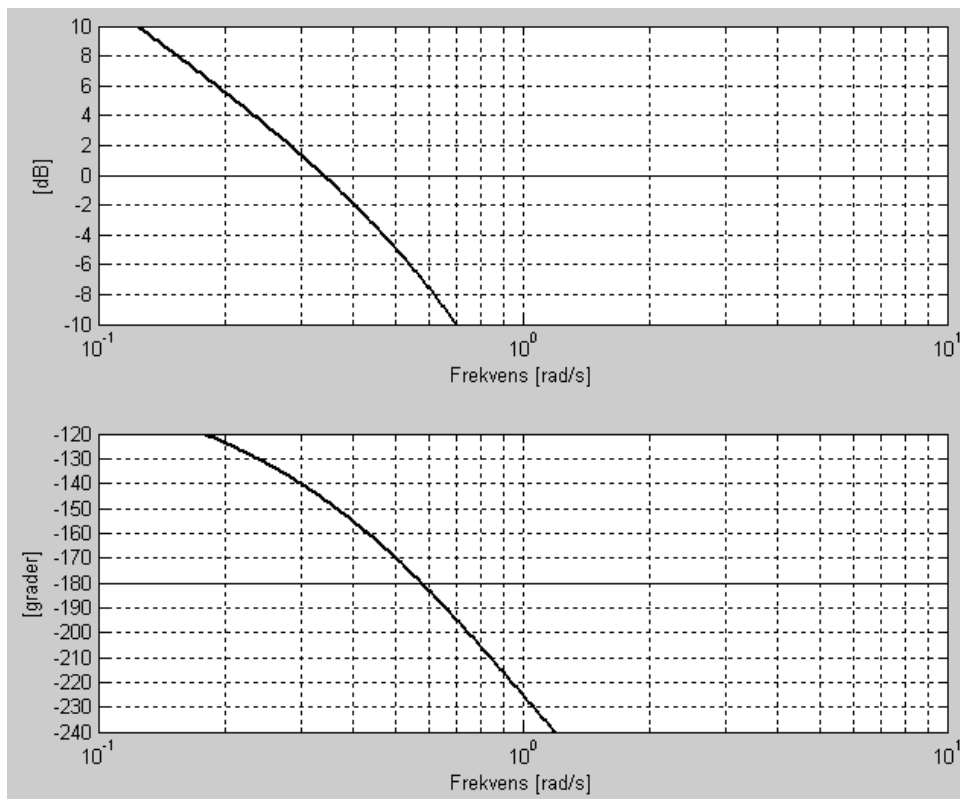


Figure 1: Exercise 0.2: Bode plot of control system

What are the stability margins GM and PM , and the crossover frequencies ω_c and ω_{180} ?

Solution 0.1

The poles are the solutions of the characteristic equation

$$z^2 - 0.25 = 0 \quad (2)$$

Thus, the poles are

$$p_1 = 0.5 \quad (3)$$

and

$$p_2 = -0.5 \quad (4)$$

Since both (all) poles lie within the unity circle, the system is asymptotically stable.

Solution 0.2

From the Bode diagram shown in Figure 1 we read off

$$\underline{\underline{GM = 7\text{dB} = 2.2}} \quad (5)$$

$$\underline{\underline{PM = 35^\circ}} \quad (6)$$

$$\underline{\underline{\omega_c = 0.34\text{rad/s}}} \quad (7)$$

$$\underline{\underline{\omega_{180} = 0.58\text{rad/s}}} \quad (8)$$