MAK 440 Design of Control Systems

Homework # 2

Due: 27/6/2024 12:00am

1) Design a PD controller for the plant function given below to reduce the settling time by a factor of 4 while continuing to operate the system with 20.5% overshoot. Assume unity feedback of the system. Compare the performance of the compensated system to that of the uncompensated system. Provide root locus plots, pzmap, and comparative step and ramp input responses. Summarize the results in a table similar to examples done in class. (5 pts).

$$G(s) = \frac{\mathrm{K}}{s(s+10)(s+20)}$$

2) A unity feedback system with forward transfer function given below is operating with a closed-loop step response that has 20% overshoot. (5 pts).

$$G(s) = \frac{K}{s(s+7)}$$

a. Evaluate the settling time.
b. Evaluate the steady-state error for a unit ramp input.
c. Design a lag-lead compensator to decrease the settling time by 2 times and decrease the steady-state error for a unit ramp input by 10 times. Place the lead zero at -3 .

d. Provide root locus plots, pzmap, and comparative step and ramp input responses.