

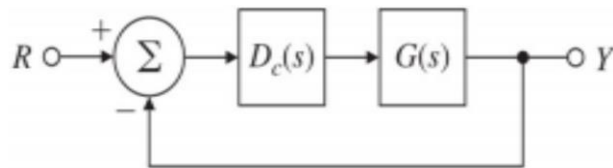
Homework 09

Due Wed. Nov. 24 by 11:59, turn in through CANVAS

Do the following problems and show all your work for full credit. Note: not all problems will be graded, but you must complete all problems to get full credit.

Problem 1 [40 pts]

Consider the following unity feedback control system shown below.



- (a) Let the open-loop plant transfer function be given as $G(s) = 1/s^2$. Design a lead compensator (controller) $D_c(s) = K^*(s+z)/(s+p)$ to be added in series with the plant so that the dominant closed-loop poles are located at $s = -2 \pm 2j$. Use Matlab to create step response plots for the new closed-loop system with the lead compensator. How does the response differ between the open-loop and closed-loop systems?

- (b) Now let $G(s) = 1/s(s+2)$. Design a lag compensator so that the dominant closed-loop poles are located at $s = -1 \pm j$ and the steady-state error due to a ramp is less than 0.2. Use Matlab to generate plots that compare the open-loop and closed-loop responses. Does the closed-loop system achieve the desired steady-state behavior? Comment on this and show proof by providing plots.