Control System: Homework 02 for Units 3A, 3B, 3C, 3D: Dynamic Response

Assigned: October 8, 2021

Due: October 21, 2021 (23:59)

1. (Laplace Transform)

3.12 Consider the standard second-order system

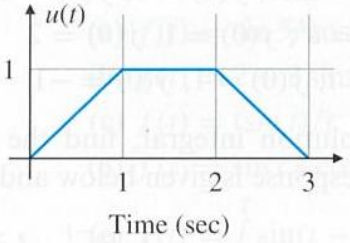
$$G(s) = \frac{\omega_n^2}{s^2 + 2\zeta\omega_n s + \omega_n^2}.$$

(a) Write the Laplace transform of the signal in Fig. 3.47.

(b) What is the transform of the output if this signal is applied to $G(s)$?

(c) Find the output of the system for the input shown in Fig. 3.47.

Figure 3.47
Plot of input signal for Problem 3.12



2. (Laplace Transform)

3.16 For a second-order system with transfer function

$$G(s) = \frac{5}{s^2 + s + 4},$$

Determine the following:

(a) The DC gain and whether the system is stable.

(b) The final value of the output if the input is applied with a step of 2 units or $R(s) = \frac{2}{s}$.

3. (Block diagram)

3.20 **Find the transfer functions for the block diagrams in Fig. 3.50.**

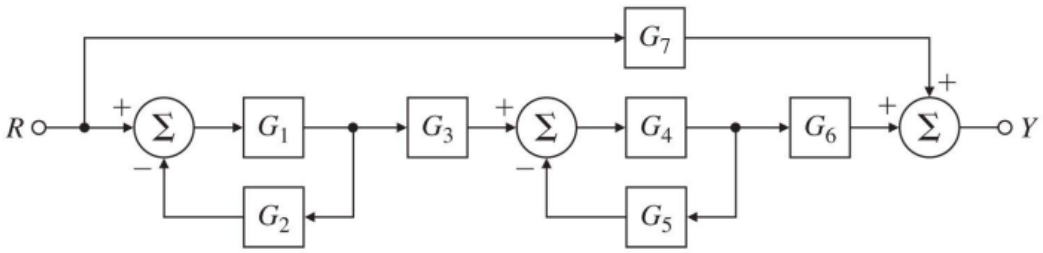


Figure 3.50 Block diagrams for Problem 3.20

4. (Time domain specification)

26. For the unity feedback system shown in Fig. 3.55, specify the gain and pole location of the compensator so that the overall closed-loop response to a unit-step input has an overshoot of no more than 25%, and a 1% settling time of no more than 0.1 sec. Verify your design using MATLAB.

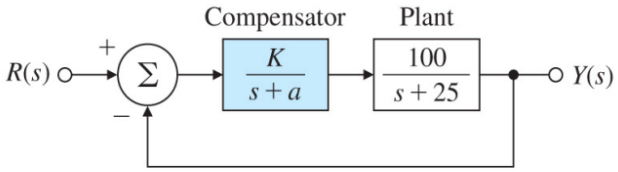


Figure 3.55: Unity feedback system for Problem 3.26