ECE-442/542 Digital Control Systems
Homework #4
Due: March 25, 2022

Instructions

1. This page must be signed and stapled to your assignment. Homework handed in without this signed page will not be graded.
2. Your signature indicates your assertion of the truth of the following statement

I acknowledge that this homework is solely my effort. I have done this work by myself. I have not consulted with others about this homework beyond the allowed level of verbal (non-written) exchanges of thoughts and opinions with my classmates. I have not received outside aid (out- side of my own brain) on this homework. I understand that violation of these rules contradicts the class policy on academic integrity.

Name: _____

Signature: _____

Date: _____

Required Problems for the Homework

1. The first page must be signed and stapled to your assignment. Homework handed in without this signed page will not be graded.

2. Your signature indicates your assertion of the truth of the following statement

Problem #1

Create two-pole system transfer functions designed to meet the requirements indicated in each part below.

a) Assume a sample period of $T = 0.02$seconds, a DC gain of 1, a zero at the origin, a percent overshoot of 20% or less, and a 1% settling time of 0.5 seconds or less.

b) Assume a sample period of $T = 0.02$seconds, a DC gain of 1, a zero at the origin, a percent overshoot of 10% or less, and a peak time of 0.2 seconds or less.

c) A DC gain of 1, a zero at the origin, a peak time of 6 sample periods or less, and a settling time of 35 sample periods.

d) Assume a sample period of $T = 0.05$seconds, a DC gain of 1, a zero at the origin, and a 1% settling time of 0.8 seconds or less.

Problem #2

Create two-pole system transfer functions designed to meet the requirements indicated in each part below.

a) Assume a sample period of $T = 0.01$seconds, a DC gain of 1, a zero at the origin, a percent overshoot of 40% or less, a peak time of 0.1 seconds or less, and a 1% settling time of 0.6 seconds or less.

b) Assume a sample period of $T = 0.01$seconds, a DC gain of 1, a zero at the origin, a percent overshoot of 20% or less, a peak time of 0.2 seconds or less, and a 1% settling time of 0.5 seconds or less.

Problem #3

Design a stabilizing controller using the Direct Design Method of Ragazzini. You may assume a sample period of 0.1 seconds. The continuous-time plant is given by $G(s) = 1/(s-1)$. You may assume the desired closed-loop transfer function will exhibit a "deadbeat response" characteristic.

Problem #4

Design a controller using the Direct Design Method of Ragazzini that produces a "deadbeat response" in the closed-loop system for the following system.

$$G(z) = \frac{0.5(z - 1.1)}{z(z - 0.9)}$$