

CDS 101/110: Homework #3

(Due Friday, October 21, 2016)

Problem 1 (CDS 101, CDS110): (15 points) Do problem 6.7 in Chapter 6 of FBS-2e.

Problem 2 (CDS 101, CDS 110): (25 points)

The goal of this problem is to explore the time domain behavior of a general 2^{nd} -order system of the form:

$$\ddot{x} + 2\zeta\omega_0\dot{x} + \omega_0^2x = \omega_0^2u.$$

we will consider the case $\zeta < 1$.

Part (a): Convert the dynamics system to first order form

Part (b): Determine and plot the impulse response of this system for the case where $C = [1 \ 0]$.

Part (c): Find the response of this system to a unit step input, assuming that $x(0) = \dot{x}(0) = 0$.

Part (d): Determine the time until the first peak in response. Knowing this time, derive an expression for the peak overshoot.

Part (e): Estimate the *rise time*, which is the time it takes from the onset of the step input until the time that the response first reaches a magnitude of one (the amplitude of the step input).

Problem 3 (CDS 110): (10 points) Do problem 6.5 in Chapter 6 of FBS-2e.

Problem 4 (CDS 110): (20 points) Do problem 6.8 in Chapter 6 of FBS-2e.