

EE 4CL4 – Control System Design

Homework Assignment #9

1. Compute the Z-transform for the discrete sequences that result from sampling the following signals a 1 Hz:

a. $e^{-0.1t} \cos(0.5t + \pi/4)$.

b. $t^2 e^{-0.25t}$. **(25 pts)**

2. Consider the following recursive equation describing the relationship between the input $u[k]$ and the output $y[k]$ in a discrete-time (sampled-data) system:

$$y[k] - 0.5y[k-1] + 0.06y[k-2] = 0.6u[k-1] + 0.3u[k-2].$$

- a. Determine the transfer function.

- b. From the above result, compute the response of the system to a unit Kronecker delta. **(25 pts)**

3. Determine the step response of the discrete-time system with the transfer function:

$$H(z) = \frac{1}{(z-0.6)^2}. \quad \textbf{(25 pts)}$$

4. Assume that, in Figure 12.6 on page 339 of Goodwin et al., $G_o(s)$ is given by:

$$G_o(s) = \frac{2}{(s+1)(s+2)}.$$

- a. Compute the Delta-Transform of the transfer function from $u[k]$ to $y[k]$, $H_{o\delta}(\gamma)$, as a function of the sampling interval Δ .

- b. Verify that, if we make $\Delta \rightarrow 0$, then:

$$\lim_{\Delta \rightarrow 0} H_{o\delta}(\gamma) \Big|_{\gamma=s} = G_o(s). \quad \textbf{(25 pts)}$$