332: 345 Final Exam — Fall 2003

Monday, Dec. 22, 2003, 9:30–11:00**am** Livingston Gym

Closed book and notes. No calculators allowed. Formulas for some Laplace and Z transform common pairs will be provided.

Final Exam (35 pts.) covers:
Chapter 6: Sections 6.1–6.4. (15 pts.)
Chapter 8: Sections 8.1–8.3 (except for Sections 8.2.4, 8.3.2, and 8.3.5), (15 pts).
Chapter 12: Section 12.1, (5 pts.).

Do all homework problems and read chapter study guides.

Solutions to homework problems are posted on the web with a hard copy placed on reserve reading in SERC.

Sample Final Exam

#1a) 8 pts. Convolve graphically continuous-time signals $p_2(t-1)$ and $\Delta_2(t-1)$.

#1b) 7 pts. Using the sliding tape method find the discrete-time convolution of the following signals

$$f_1[k] = \begin{cases} 1 & k=0 \\ -2 & k=2 \\ 3 & k=3 \\ -1 & k=4 \\ -2 & k=5 \\ 0 & \text{otherwise} \end{cases}, \qquad f_2[k] = \begin{cases} -1 & k=-2 \\ 5 & k=0 \\ 1 & k=1 \\ 2 & k=2 \\ 0 & \text{otherwise} \end{cases}$$

#2a) 8 pts. Consider the continuous-time linear system represented in the state space form by

$$\begin{bmatrix} \dot{x}_1(t) \\ \dot{x}_2(t) \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} f(t), \quad \begin{bmatrix} x_1(0^-) \\ x_2(0^-) \end{bmatrix} = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$$
$$y(t) = \begin{bmatrix} 1 & 1 \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix}$$

a) Find the system transfer function.

b) Find the system impulse response.

c) Find the system transition matrix using the Laplace transform.

d) Find the system output response ($y(t)$) due to the system input $f(t) = e^{-t}u(t)$.

#2b) 7 pts. Consider the discrete-time linear system represented in the state space form by

$$\begin{bmatrix} x_1[k+1] \\ x_2[k+1] \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -\frac{1}{4} & -1 \end{bmatrix} \begin{bmatrix} x_1[k] \\ x_2[k] \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} f[k], \quad \begin{bmatrix} x_1[0] \\ x_2[0] \end{bmatrix} = \begin{bmatrix} 2 \\ -1 \end{bmatrix}$$
$$y[k] = \begin{bmatrix} 1 & 1 \end{bmatrix} \begin{bmatrix} x_1[k] \\ x_2[k] \end{bmatrix}$$

a) Find the system transfer function.

b) Find the system transition matrix.

c) Find the system output response ($y[k]$) due to the system input $f[k] = (0.5)^k u[k]$ (use any method).

#3) 5 pts. Any of 12.1–12.4 problems.