LINEAR SYSTEMS—Ph.D. Qualifying Exam Spring 2008

Part A (5 pts.)

Determine the poles and zeros of the continuous-time linear time-invariant system with transfer function given by

$$H(s) \;=\; \frac{1}{e^s + 10}$$

Assuming that the system is causal, determine whether it is bounded-input, bounded-output stable.

Part B (4 pts.)

Consider the linear time-invariant systems with impulse responses

1. $h(t) = \delta(t) - \delta(t-2)$
2. $h(t) = 2e^{-4t}u(t)$

Is either system: memoryless; causal; stable?

Part C (6 pts.)

Consider the discrete-time system defined by the input-output relationship

$$y[n] \;=\; \left(\frac{n+2.5}{n+1.5}\right)^2 x[n]$$

1. Is the system memoryless?
2. Is the system invertible?
3. Is the system causal?
4. Is the system stable?
5. Is the system time-varying?
6. Is the system linear?

Part D (5 pts.)

A discrete-time linear time-invariant system has transfer (system) function given by

$$H(z) \;=\; \frac{1}{(z-0.1)(z-0.5)(z+0.2)}$$

For each of the possible regions of convergence, determine whether the corresponding system is

- causal
- bounded-input, bounded-output stable