Homework 5

System Properties, LTI Systems, Impulse Functions

Reading: Chapter 4 and 5 of Course Notes

Complete the following problems on engineering paper using the problem solving format and submit the assignment at the beginning of class.

1.   Chapter 4, Problem 4.2 from the Course Notes

2.   Chapter 4, Problem 4.3 from the Course Notes

3.   Chapter 5, Problem 5.1 from the Course Notes

4.   Chapter 5, Problem 5.3 from the Course Notes

5.   Chapter 5, Problem 5.5 from the Course Notes

6.   A linear time-invariant system responds to the following inputs with the corresponding outputs:

If $x(t) = u(t)$, then $y(t) = (1 - e^{-2t})u(t)$

If $x(t) = \cos(2t)$, then $y(t) = 0.707 \cos(2t - \pi/4)$

If $x(t) = \sin(4t)$, then $y(t) = 0.5 \sin(4t - \pi/6)$

Find $y(t)$ for the following inputs:

a. $x(t) = 4 \sin(4t) + 2 \sin(4(t-2))$

b. $x(t) = 4 \cos(4t)$

c. $x(t) = 2u(t) - 2u(t-1)$

d. $x(t) = 4\cos(2(t-2))$

e. $x(t) = 5u(t) + 10\cos(2t)$

f. $x(t) = \delta(t)$

g. $x(t) = tu(t)$

7.   Determine whether the following systems are invertible and BIBO stable.

a. $y(t) = u(x(t))$

b. $y(t) = x(t-5) - x(3-t)$

c. $y(t) = x(t/2)$

d. $y(t) = \cos(2\pi t)x(t)$

e. $y(t) = |x(t)|$

f. y(t) = 1/(x(t)-sin(t))

Scrambled Answers: only one is invertible, one is not stable