Discussion 3

ECE 102: Systems and Signals

Winter 2022

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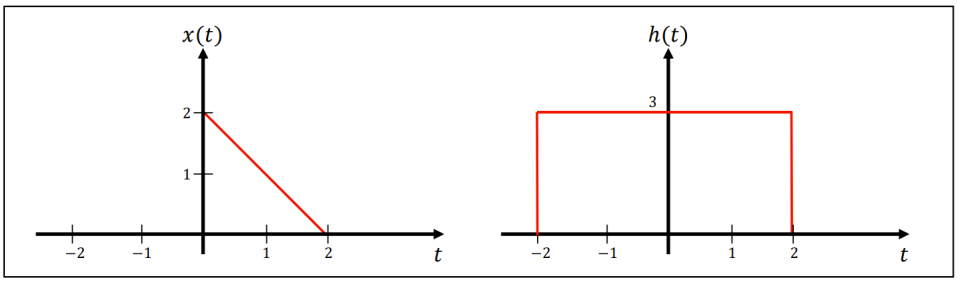
1. Convolution Integral

Consider signals $x(t)$ and $h(t)$ below.



(a) Graphically convolve $x(t)$ and $h(t)$.

(b) Write analytical equations for $x(t)$ and $h(t)$.

(c) Analytically convolve $x(t)$ and $h(t)$.

2. Impulse response function

The system S is given by the following relation

$$y(t) = x(t) + e^{-t}x(t)u(t+1), \quad -\infty < t < \infty$$

(a) Is the system linear? Is the system time-varying or time-invariant? Is the system causal or not causal? Justify your answer.

(b) Find the impulse response function of the system.

(c) Compute the response of the system to input $X(t) = e^{-t}u(t-2)$.

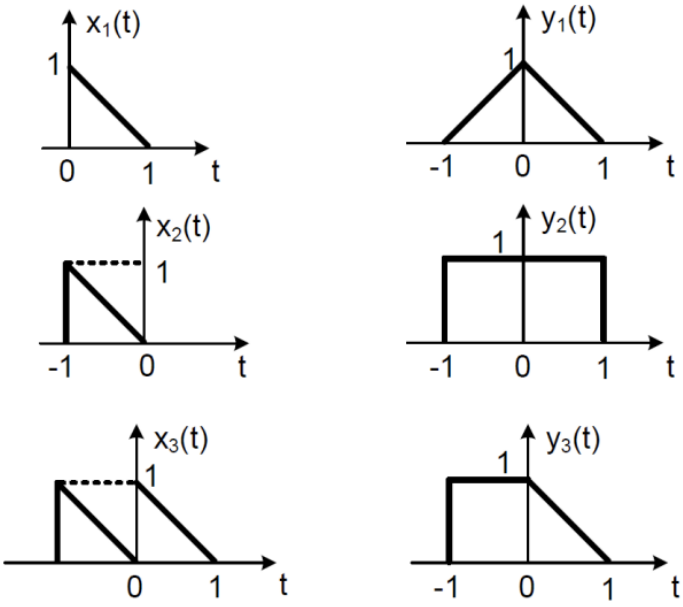
3. System properties

For a given system S, consider the outputs $y_1(t), y_2(t)$, and $y_3(t)$, corresponding to inputs $x_1(t), x_2(t)$, and $x_3(t)$, respectively, as shown in the figure.

(a) Is the system linear or not? Explain.

(b) Is the system TI or TV? Explain.

(c) Is the system C or NC ? Explain.


x1(t)
1
0
1
t
y1(t)
1
-1
0
1
t
x2(t)
1
-1
0
t
y2(t)
1
-1
0
1
t
x3(t)
1
0
1
t
y3(t)
1
-1
0
1
t