Discussion 2

ECE 102: Systems and Signals

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1 Problems

1.1 System Linearity, Time Invariance, and Causality

The system S has the following IPOP:

$$y(t) = x(t-2) + x(2-t), \quad -\infty < t < \infty$$

(a) Is the system S linear? Provide a proof.

(b) Is the system S time variant (TV) or time invariant (TI)? Justify your answer.

(c) Is the system S causal (C) or non-causal (NC) ? Justify your answer.

1.2 Unit Impulse Function in Integration

Given the following input-output relation (IPOP) of a system:

$$y(t) = \int_{-\infty}^{\infty} e^{-t}(t-\tau)u(\tau-t)x(\tau)d\tau, t \in (-\infty, \infty).$$

a) Find impulse response of the system $h(t,\tau)$. Is the system time variant (TV) or time invariant (TI)? Is it causal (C) or non-causal (NC)?

b) Find the corresponding output, $y(t)$, given an input of:

$$x(t) = \delta(t-2) - e^{-t}u(t), \quad t \in (-\infty, \infty)$$

1.3 Step Response

Compute the step response for following system IPOPs $y_1(t)$ and $y_2(t)$:

$$y_1(t) = \int_{-\infty}^{t} (t-\tau)e^{-2(t-\tau)}x(\tau-2)d\tau, t > -\infty$$

$$y_2(t) = \int_{-1}^{4} e^{-2t}x(t-2)dt$$