

EE411 Homework 4

1. (3.4-1) Use the definition of linearity to determine which of the following systems with input signal $x(t)$ and output signal $y(t)$ are linear.

(a) $y(t) = ax(t) + b$, where $a, b \neq 0$.

(b) $y(t) = A \cos[x(t)]$, where A is constant.

(c) $y(t) = e^{j\omega_0 t} x(t)$.

(d) $y(t) = A \cdot x(t) \cdot \cos \omega_0 t$

(e) $y(t) = A \int_{-\infty}^{\infty} p(t - \tau) x(\tau) d\tau$

2. (3.4-3) For a linear system with frequency response

$$H(f) = \frac{1}{1 + j2\pi f}$$

Find the output signal $y(t)$ of this system when the input signal is given by

$$x(t) = 1 + 2\delta(t - t_0)$$

3. For the LTI system shown below, the unit impulse response is $h(t) = e^{-t}u(t)$. Find the system response $y(t)$ and the output energy spectral density if the input $x(t)$ is $x(t) = e^{-3t}u(t)$.

