

H9-08

4. Given the LTI system with unit-impulse response $h(t) = e^{-4|t|}$, compute the Fourier series representation for the response $y(t)$ of the system to the input signal

(a) $x(t) = \sum_{n=-\infty}^{\infty} \delta(t-n)$

(b) $x(t) = \sum_{n=-\infty}^{\infty} (-1)^n \delta(t-n)$

5. A continuous-time periodic signal $x(t)$ has Fourier series coefficients

$$X_k = \begin{cases} (6/jk)e^{jk\pi/4}, & k = \pm 1, \pm 3 \\ 0, & \text{else} \end{cases}$$

Compute and sketch the magnitude and phase spectra of the signal.

6. Answer, with justification, the following questions about the response of the stable LTI system with frequency response function

$$H(\omega) = \frac{5}{3 + j\omega}$$

(a) For a periodic input signal $x(t)$ that has fundamental period $T_o = 2\pi$, what harmonics will appear in the output signal $y(t)$ with diminished magnitude? That is, what values of k yield $|Y_k| < |X_k|$?

(b) For a periodic input signal that has fundamental period $T_o = \pi$, what harmonics will appear in the output signal with diminished magnitude?

7. Answer, with justification, the following questions about the response of the LTI system that has impulse response $h(t) = 25t e^{-3t} u(t)$.

(a) For a periodic input signal $x(t)$ that has fundamental period $T_o = 2$, what harmonics will appear in the output signal $y(t)$ with diminished magnitude? That is, what values of k yield $|Y_k| < |X_k|$?

(b) For a periodic input signal that has fundamental period $T_o = 4\pi$, what harmonics will appear in the output signal with diminished magnitude?

8. Consider the LTI system that has impulse response $h(t) = \delta(t) - e^{-2t} u(t)$, and suppose the input signal is $x(t) = 1 + 2\cos(t) + 3\cos(2t)$. Compute the response $y(t)$.

9. Consider the LTI system that has impulse response $h(t) = te^{-t} u(t) + 2e^{-t} u(t) - \delta(t)$, and suppose the input signal is $x(t) = 2 + 2\cos(t)$. Compute the response $y(t)$.