

ELEC 309

Signals and Systems

Homework 1 Assignment

Time-Domain Analysis of Signals

1. Find the even and odd components of each of the following signals:

(a) $x(t) = \cos(t) + \sin(t) + \sin(t) \cos(t)$

(b) $x[n] = 1 + n + 3n^2 + 5n^3 + 9n^4$

(c) $x(t) = 1 + t \cos(t) + t^2 \sin(t) + t^3 \sin(t) \cos(t)$

(d) $x[n] = (1 + n^3) \cos^3(10n)$

2. For each of the following signals, determine whether it is periodic, and if it is, find the fundamental period:

(a) $x(t) = \cos^2(2\pi t)$

(b) $x(t) = \sin^3(2t)$

(c) $x(t) = e^{-2t} \cos(2\pi t)$

(d) $x[n] = (-1)^n$

(e) $x[n] = (-1)^{n^2}$

(f) $x[n] = \cos(2n)$

(g) $x[n] = \cos(2\pi n)$

3. Categorize each of the following signals as an energy signal or a power signal, and find the energy or time-averaged power of the signal:

(a) $x(t) = 5 \cos(\pi t) + \sin(5\pi t)$

(b) $x(t) = \begin{cases} 5 \cos(\pi t) & -1 \leq t \leq 1 \\ 0 & \text{otherwise} \end{cases}$

(c) $x[n] = \begin{cases} \sin(\pi n) & -4 \leq n \leq 4 \\ 0 & \text{otherwise} \end{cases}$

(d) $x[n] = \begin{cases} \cos(\pi n) & -4 \leq n \leq 4 \\ 0 & \text{otherwise} \end{cases}$

(e) $x[n] = \begin{cases} \cos(\pi n) & n \geq 0 \\ 0 & \text{otherwise} \end{cases}$

4. Let

$$x[n] = \begin{cases} n & \text{for } n \text{ odd} \\ 0 & \text{otherwise.} \end{cases}$$

Determine $y[n] = x[2n]$.

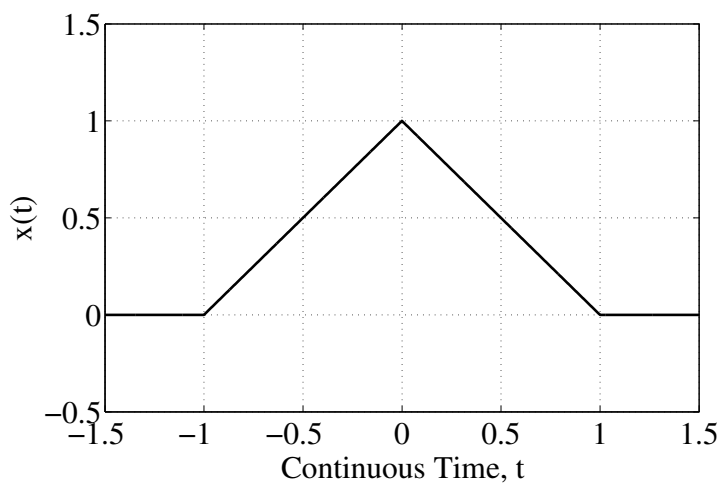


Figure 1: Triangular Pulse Signal

5. A triangular pulse signal $x(t)$ is depicted in Figure 1. Sketch each of the following signals derived from $x(t)$:

(a) $x(3t + 2)$

(b) $x(-2t - 1)$