EI331 Signals and Systems

Homework 1

Due: Tuesday, March 5

February 28, 2019

1. Figure 1 shows the CT signal $x(t)$. Let $x_e(t)$ and $x_o(t)$ be the even and odd parts of $x(t)$, respectively.

$$x(t) = \begin{cases} 2(t+2), & -2 \le t \le -1, \\ 1-t, & -1 \le t \le 1, \\ 0, & \text{otherwise} \end{cases}$$

Figure 1: $x(t)$

Sketch and label the following signals.

(a). $x_1(t) = x_e(2t+1)$

(b). $x_2(t) = -x_o(1 - \frac{2}{3}t)$

2. Determine whether the following continuous-time signals are periodic. If a signal is periodic, find its fundamental period.

(a). $x(t) = \cos(5t) + \sin(3t + 2)$

(b). $x(t) = \cos(t)\cos(\sqrt{2}t)$

(c). $x(t) = \cos^2(t)$

3. Determine whether the following discrete-time signals are periodic. If a signal is periodic, find its fundamental period.

(a). $x[n] = \cos(n^2)$

(b). $x[n] = \cos(\frac{16\pi}{9}n)$

(c). $x[n] = \cos(\frac{4\pi}{3}n) + \sin(\frac{3\pi}{5}n)$

4. Find all the distinct 5th roots of $1 + j\sqrt{3}$.

5. Sketch and describe the set of all complex numbers satisfying $|z - j| = 1$.

6. Decide whether the following series are convergent. Justify your answers.

(a). $\sum_{n=1}^{\infty} 2^{-n}(1 + e^{jn})$

(b). $\sum_{n=2}^{\infty} \left(\dfrac{1}{n^2} + \dfrac{j}{n \log n} \right)$