

EECS 360
Homework #1
Spring 2021
Signal Manipulations

1. Plot

$$x_1(t) = 10\cos(2\pi 1000t), x_2(t) = 10\cos(2\pi 1000(t - 62.5\mu s)), \text{ and } x_3(t) = 10\cos(2\pi 1000t - \frac{\pi}{8})$$

Compare these three signals and explain their similarities and differences.

2. Plot

a. $x(t) = \sum_{i=-n}^n 2\text{rect}(\frac{t-i}{0.25}) \quad n = 2$

b. Sketch $x(t)$ as $n \rightarrow \infty$

3. A Binary Phase Keyed (BPSK) modulation is used to modulate binary information onto a radio frequency (RF) carrier. Given a set of information bits $b_i = \{-1, 1, -1, 1\}$. A modulated RF signal

is $y(t) = \sum_{i=1}^4 b_i \text{rect}(t - i - .5) \cos(2\pi 12t)$ Plot $y(t)$ for $0 < t < 4$.

Repeat for $b_i = \{1, 0, 1, 0\}$ (This an example of modulation using on-off keying).

4. Plot $\frac{1}{2} + \sum_{n=1}^5 \frac{1}{n\pi} \sin(2\pi nt)$ for $-3 < t < 3$

5. Plot the magnitude $|X(f)|$ and phase angle of the following complex function for $-1 < f < 1$

$$X(f) = 2\text{rect}(f)e^{-j4\pi f}$$

6. For a sequence of information bits $d_i = \{1, 0, 1, 1, 1, 0\}$; $i=0..5$ a message signal $m(t)$ is formed as shown below, here let with $\tau = 1\text{ms}$. Plot the message signal $m(t)$ for $0 < t < 7\text{ms}$.

$$m(t) = \sum_{k=0}^5 d_k \text{rect}\left[\frac{t - \frac{(2k+1)\tau}{2}}{\tau}\right]$$