

EE 567

Homework 1

Due Tuesday, September 3, 2019

Work all 4 problems.

Problem 1. Compute the Fourier transform of the pulse, $x(t)$, defined by

$$x(t) = \begin{cases} 1 - t, & 0 < t \leq 1, \\ 0, & \textit{elsewhere} \end{cases}$$

and sketch a plot of its graph in the frequency domain. You should produce two plots (one for the magnitude of the Fourier transform and one for the phase). In the magnitude plot, clearly identify where the maximum height occurs and the value of the maximum height. Also, identify where the first zero-crossings in the Fourier transform closest to the peak magnitude occur (if there are any).

Problem 2. Use direct integration to find the Fourier transform of the signal

$$g(t) = \exp(-|t|), \quad -\infty < t < \infty.$$

Problem 3. Determine which of the following systems is linear.

- $y(t) = x(t)$.
- $y(t) = x^2(t)$.
- $y(t) = c_1x(t + 1) + c_2x(t - 1)$, $c_1, c_2 \neq 0$.
- $y(t) = t \cdot x(t)$, $t > 0$.

Problem 4. Find the constant k such that

$$\int_{-\infty}^{\infty} \text{sinc}(kt) dt = 1.$$