## ELEC 309 Signals and Systems Homework 7 Assignment

## Frequency-Domain Analysis of Signals and Systems

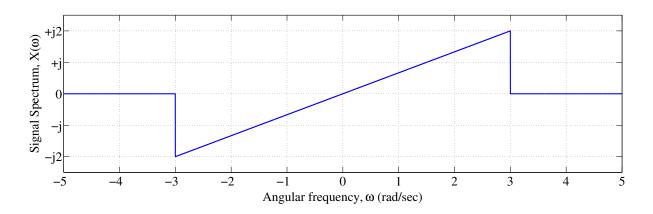


Figure 1: Signal spectrum  $X(\omega)$  for Problem 1

- 1. For the Fourier spectrum  $X(\omega)$  shown in Figure 1:
  - (a) Determine a single mathematical expression for the Fourier spectrum  $X(\omega)$ . Hint: You should use the **rect**() function discussed in class!

(b) Find signal x(t) by using the inverse Fourier transform integral (Equation 33 in the class notes).

(c) Find signal x(t) by using the table of Fourier transform pairs and the Differentiation in the Time Domain property (Equation 40 in the class notes).

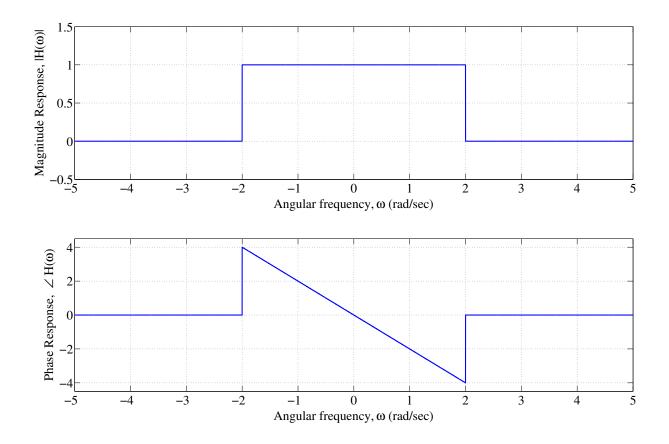


Figure 2: Frequency response  $H(\omega)$  for Problem 1

- (d) Determine a single mathematical expression for the frequency response  $H(\omega)$  shown in Figure 2. Hint: You should use the **rect**() function discussed in class!
- (e) For the LTI system with frequency response  $H(\omega)$  shown in Figure 2, determine the impulse response h(t) by using the table of Fourier transform pairs and the Time Shifting property (Equation 35 in the class notes).
- (f) For the LTI system with frequency response  $H(\omega)$  shown in Figure 2, determine if the system is causal.
- (g) For the LTI system with frequency response  $H(\omega)$  shown in Figure 2, determine the output Fourier spectrum  $Y(\omega)$  if the input signal to the LTI system is x(t).
- (h) For the LTI system with frequency response  $H(\omega)$  shown in Figure 2, determine the output signal y(t) if the input signal to the LTI system is x(t).

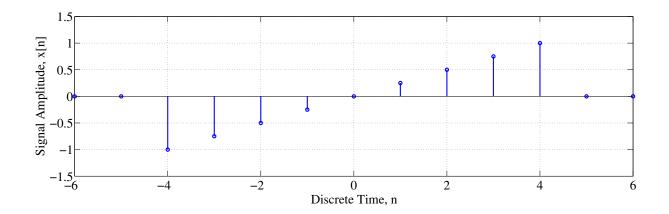


Figure 3: Discrete-time signal x[n] for Problem 2

- 2. For the discrete-time signal x[n] shown in Figure 3:
  - (a) Determine the Fourier spectrum  $X(\Omega)$ . Simplify your answer as much as possible.

(b) Determine the fundamental period for the spectrum  $X(\Omega)$ .