

Homework #6

This homework is worth 50% of other homeworks.

1) Consider the function $x(t) = 2 \sin(\omega_0 t) + 2 \sin(2\omega_0 t)$:

- a) What is its fundamental period?
- b) Compute its Fourier coefficients a_k
- c) What the average value of this signal, and how is it related to a_0 (and why)?
- d) Compute the signal's average power per period using $x(t)$.
- e) Compute the signal's average power per period using a_k . Does it agree? Should it?
- f) How do the answers to (a)-(c) change for the related signal $x(t) = 1 + 2 \sin(\omega_0 t) + 2 \sin(2\omega_0 t)$?

2)

a) Consider the function $x(t) = \sum_{l=-\infty}^{\infty} \left(u(t-lT) - u\left(t - \frac{T}{2} - lT\right) \right)$

- i) What is its fundamental period?
- ii) Sketch $x(t)$ for at least one period, including sections on both sides of $t = 0$.
- iii) Compute its Fourier coefficients a_k . You may need to evaluate its DC component a_0 separately.
- iv) What the average value of this signal, and how is it related to a_0 ?
- v) Is $x(t)$ even, odd, or neither?
- vi) Is a_k even, odd, or neither? And how does that square with the previous answer?

b) Repeat for $x(t) = -\frac{1}{2} + \sum_{l=-\infty}^{\infty} \left(u(t-lT) - u\left(t - \frac{T}{2} - lT\right) \right)$. Hint: Use the previous results.

c) Repeat for $x(t) = \frac{d}{dt} \left(-\frac{1}{2} + \sum_{l=-\infty}^{\infty} \left(u(t-lT) - u\left(t - \frac{T}{2} - lT\right) \right) \right)$. Hint: Use the previous results. Another

hint: See HW 5, problem 4(d).