ECE 301 Homework Assignment 8

Take the first four letters of your last name and the first four of your first name. Since I will be generating an answer key using Matlab, please use your “official” name string from the following list.


For purposes of illustration, suppose the result is “AsdfZxcv”. We will construct signals from the name string. First, replace the string of characters by their location in the alphabet (ignoring case). For example

“AsdfZxcv” → (1, 19, 4, 6, 26, 24, 3, 22).

I will call the resulting string of numbers the “value string” to distinguish it from the original name string.

1. As in Example 8.4 on page 789, consider sampling a continuous-time sinusoid at \( f_s = 1000 \) Hz. Let the first four values in your value string be \( v_1, v_2, v_3, \) and \( v_4 \). Determine the frequency \( f_a \) of the discrete time sinusoid observed after sampling if the original signal has frequency

(a) \( 100v_1 \) Hz,
(b) \( 100v_2 \) Hz,
(c) \( 100v_3 \) Hz,
(d) \( 100v_4 \) Hz.

(For our friend “AsdfZxcv” these would be 100, 1900, 400, and 600 Hz."

2. Use the values \( v_3, v_4, v_5, \) and \( v_6 \) of your value string to form

\[
x[n] = v_3 \cos\left(\frac{v_4}{10}\pi n\right) + v_5 \sin\left(\frac{v_6}{10}\pi n\right).
\]

For “AsdfZxcv” this would be \( x[n] = 4 \cos(0.6\pi n) + 26 \sin(2.4\pi n) \).

(a) Express your \( x[n] \) as a discrete time Fourier series.
(b) Find the spectra \( |D_r| \) and \( \angle D_r \).

3. Let the last four values in your value string be \( v_5, v_6, v_7, \) and \( v_8 \). Find

(a) the DTFT of

\[
x[n] = v_5 \delta[n - v_6] + \left(\frac{\min(v_7, v_8)}{\max(v_7, v_8)}\right)^n u[n],
\]
(b) the DTFT of
\[ x[n] = \sum_{n=-v_6}^{v_7} \delta[n], \]

(c) the IDTFT of
\[ X(\Omega) = \frac{1}{v_5 e^{-j\Omega} - 1}, \]

(d) and the IDTFT of
\[ X(\Omega) = \frac{v_8 e^{-j\Omega}}{(v_8 - e^{-j\Omega})^2}. \]