ECE 312 HW #5

This is a MATLAB programming homework assignment.

The signal *x*(*t*) is the sum of a 5 Hz cosine wave with a magnitude of 0.4 and a 20 Hz sine wave with a magnitude of 1.0. This signal is sampled at 1000 Hz and 1000 total samples are taken.

1. Using MATLAB plot 200 milliseconds of *x*(*t*).
2. Using MATLAB, compute the DFT and plot the absolute value of the first 40 harmonics (i.e., |*Ck*| for *k* = 0, 1, …, 39).
3. Use a CTFS to compute the first 40 harmonics. How do they compare to the DFT harmonics? (Explain any differences.)

You must turn in your MATLAB source code and a copy of the two plots generated by MATLAB.

NOTE: MATLAB uses the fast-fourier transform (FFT) to compute the DFT. The syntax of this library function is

fft(y)

where ‘y’ is a vector of sampled values of the signal *x*(*t*). fft(y) returns a vector of complex harmonics.

The FFT is not a new Fourier Transform. It is just a more computationally efficient algorithm for a DFT. We will discuss this later in class.

To generate a stem plot to plot the harmonics you need to insert the following code into your MATLAB program:

z = 0:39;

stem(z,p(1:40),'filled')

What this code does is first generate a 40-element vector ‘z’ with values 0, 1, 2, …, 39. The vector ‘p’ contains the absolute value of the first 40 harmonics.