Experiential DSP 02 Solutions

Part A: Plot and Observe!

1) Plot:

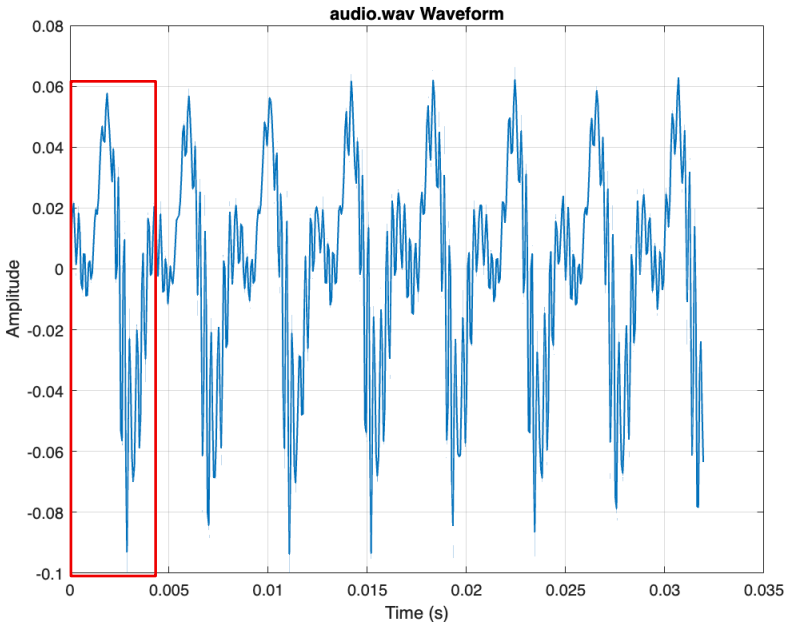

Figure 1: Waveform plot of `audio.wav`

2) The red box shows one period of the signal, which is about **4.5 ms**. This is our estimated period of the signal.

Part B: DTFT in MATLAB

1. Plot:

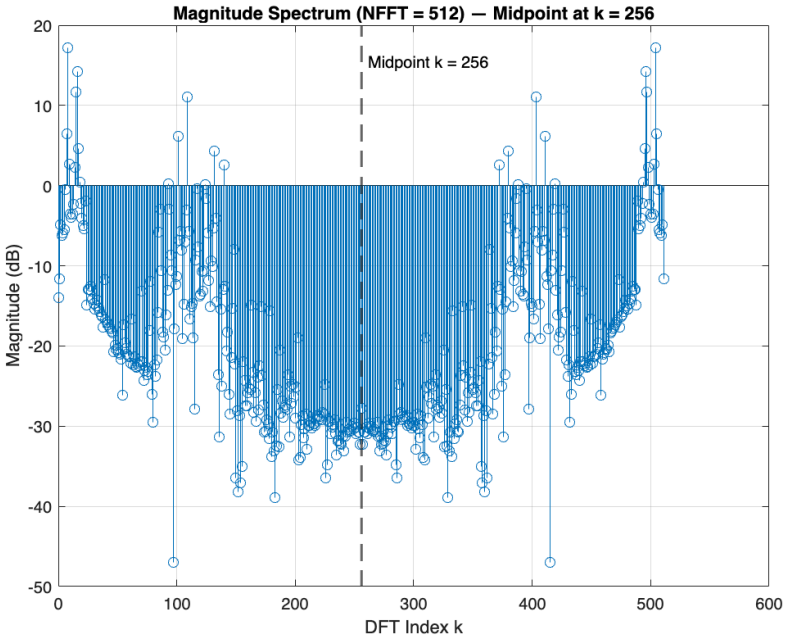

Figure 2: 512-point DFT magnitude with midpoint line

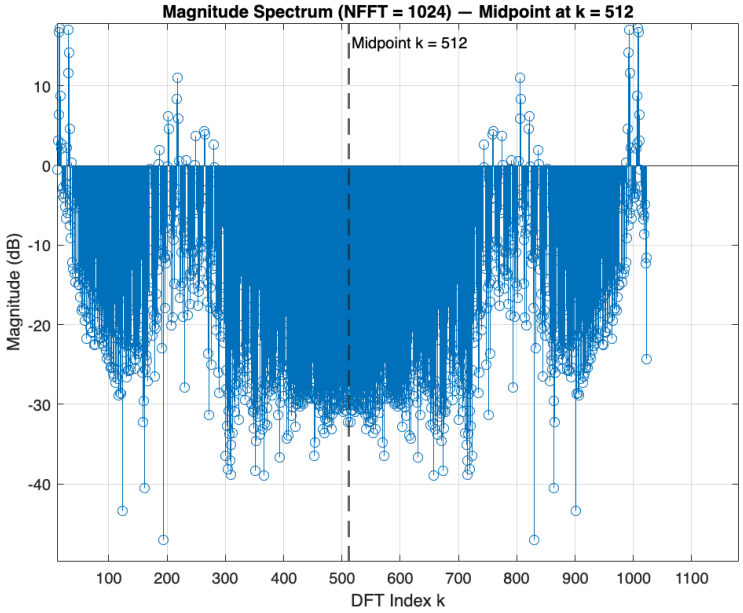

Figure 3: 1024-point DFT magnitude with midpoint line

2. When we compare the portion of the datapoints with respect to the middle point in Figures 2 and 3, we can see in both figures that there is a symmetry in which the portion of the datapoints on the left and right of the middle point is equal to each other.
3. When we compute a 1024-point FFT of the same signal, we are effectively zero-padding the input. This gives a finer sampling of the same frequency spectrum. The 512-point FFT samples appear at every other bin of the 1024-point FFT. In other words: $X512[k] \leftrightarrow X1024[2k], k = 0,1, \dots ,511$