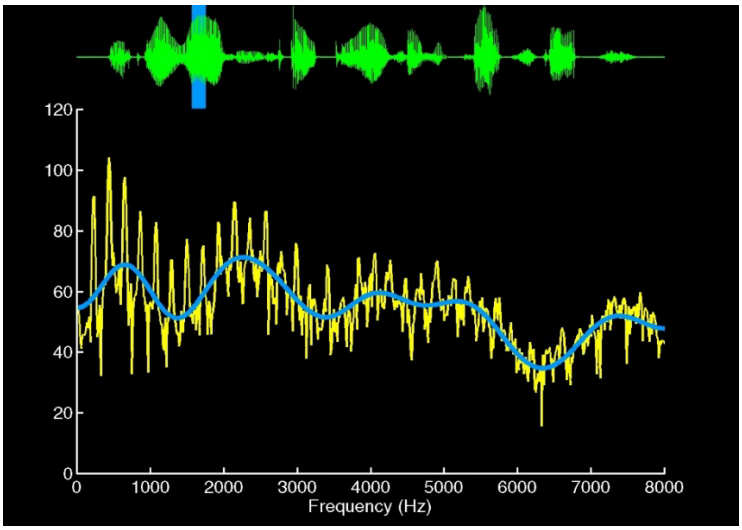
Homework #3

EELE 578
Assignment Date: 10/21/2022
Due Date: 11/4/2022

Using the sentence that you picked for HW#2, pick three different vowels in the sentence, and perform the following for each vowel:

1. Homomorphic Signal Processing
    a. Find the cepstral coefficients using homomorphic signal processing and plot these coefficients. Do you see any peaks associated with the pitch period?
    b. Plot the spectrum of the vowel, similar to the yellow lines in the figure below (a 1024-point FFT was used). What are the frequencies of the first two formants?
    c. Low pass "lifter" the cepstral coefficients by only keeping the first N coefficients (in the plot below, the first 14 coefficients were kept). Be aware that you will need to keep the complex conjugate pairs, similar to negative frequencies when you perform an iFFT. Transform back to the frequency domain and plot the resulting curve on top of the spectrum. In the figure below, the blue curve was created by eliminating the pitch period spectrum by keeping only the first 14 cepstral coefficients.
    d. Create plots for each of the three vowels and annotate what the first two formant frequencies are for each vowel.



2. Linear Prediction. For each of the three vowels, compute the linear prediction coefficients using (assume P=14):
    a. Least Squares Solution (page 9 in pdf)
    b. Autocorrelation Method (page 14 in pdf)
    c. Plot the spectrum of these coefficients (e.g. freqz()) and create a plot for each vowel where you compare the "liftered" spectrum from 1.c and the spectrum from 2.a and 2.b.