EE 679 Speech Processing
Computing Assignment 1B: Signal analysis with the DFT

Due on September 23, 2021 11 pm

Note: This assignment is a continuation of CA 1A. Please see the following updated instructions:
You can use Python (recommended), Octave or Matlab/Scilab. Make a single zipped folder for Moodle submission that includes a html or pdf report (with the solution for each question including method, important code fragments, plots and discussion) and sound files. Make sure to put your name and roll number to the top of report. Make neat and properly labeled plots.

Alternately, if you use Jupyter notebook, you should compulsorily submit your ipynb file together with the html version of your assignment (which should contain all the components of the report plus sounds, make sure to add your name and roll number to the top of ipynb and html).

Use your previous synthesized vowel /u/ at two distinct pitches (F0 = 120 Hz, F0 = 220 Hz). Keep the bandwidths constant at 100 Hz for all formants.

Vowel F1, F2, F3
/u/ 300, 870, 2240

We would like to use the DFT computed with various window lengths and shapes to estimate the vowel's F0 and formant frequencies and study the obtained accuracies with reference to our 'ground truth' values. For the analysis, use a single waveform segment near the centre of your synthesized vowel.

Plot the magnitude (dB) spectrum with rectangular and Hamming windows of lengths: 5 ms, 10 ms, 20 ms, 40 ms, each with a large zero-padded DFT. (i) Comment on the similarities and differences between the different computed spectra. (ii) Estimate the signal parameters from each of the magnitude spectra and report the error with respect to the ground-truth.