Lab Exercises 4
ELEC 9723

Part 1

Write a function in MATLAB that accepts as inputs

- **a speech signal (array)**
- **its sampling frequency (value)**
- **the length of the analysis window (value) (optional)**
- **the shape of the window (array) (optional)**
- **the duration separating the midpoints of two consecutive windows (optional)**

and produces as outputs formant contours corresponding to the first three formants of that signal. Estimate the formant frequencies based on positions of the local maximas of the magnitude response of the all-pole model of the vocal tract obtained via linear predictive (LP) analysis.

Part 2

A spectrogram is created by dividing a signal into frames, computing the magnitude spectrum corresponding to each frame and putting them together in a matrix (as either rows or columns) and then displaying the matrix as an image. Similarly, write a function in MATLAB that accepts as inputs

- **a speech signal (array)**
- **its sampling frequency (value)**
- **the length of the analysis window (value)**
- **the shape of the window (array) (optional)**
- **the duration separating the midpoints of two consecutive windows**

and produces as output an LPC spectrogram, which is similar to a regular spectrogram except that instead of computing the magnitude spectrum of each frame, estimate the LP parameters and from these parameters compute the magnitude response of the vocal tract model.

1. Read a speech files (`sample2.wav, sample3.wav and sample4.wav`) and extract formant contours for all of them.

2. Plot the spectrograms and LPC spectrograms corresponding to the speech files and overlay the pitch contour on both of them. (Make sure the axes are labelled appropriately or the overlay will not work)

3. The three files are speech samples from three different people saying the same thing. Do you expect the formant contours to be different or the same? Do you observe what you expect?