EE-414 Speech Processing Lab
Lab-2
17/01/2021

Aim

- To understand the difference between stationary and non-stationary signals.
- To get a feel about the non stationary nature of speech signals.
- To understand the limitations of Fourier transform in case of non-stationary signals.

Problem Statement

A. Generation of a singletone sine wave and its spectrum.
    a. Generate a 10 Hz sine wave sampled at 1000 Hz sampling frequency and for a duration of 1 sec for this problem.
B. Generation of a multitone sine wave and its spectrum.
    a. Generate a multitone sine wave composed of 10, 50 and 100 Hz frequency components. Use a sampling frequency of 1000Hz and a wave of duration 1 sec for the problem.
C. Generation of a non-stationary multitone sine wave and its spectrum
    a. Generate a non-stationary multitone sine wave made of different combinations of 10, 50 and 100 Hz components. Example combination:
        i. $\sin(2\Pi*10*t)$ $0 < t < 0.2$ sec
        ii. $\sin(2\Pi*10*t) + \sin(2\Pi*50*t)$ $0.2 < t < 0.5$ sec
        iii. $\sin(2\Pi*10*t) + \sin(2\Pi*50*t) + \sin(2\Pi*100*t)$ $0.5 < t < 1$ sec
    b. Generate the frequency spectrum taking the whole signal at once and taking each stationary part of the signal individually. Record your observations on the spectrum obtained by using the whole signal, the stationary parts individually and the limitations of Fourier Transform when we consider the whole non-stationary speech signal.
D. Plotting waveform and spectra of speech signal.
    a. Record the phrase **'Sakshaat Speech Processing'** and save it in a .wav file. Now, (re)sample the speech signal to 8kHz and plot the speech signal.
    b. Compute and plot the spectrum of the different categories of sounds present in the recorded speech file. Inspect the spectral properties of sounds belonging to different categories, and comment on the nature of the whole speech signal.

Submission

Submit a single pdf file, consisting of the following for each problem:

- Theory
- Procedure to carry out the experiment
- Code (matlab/python)
- Plots of the signal in time domain and the magnitude spectrum.
- Observations/Explanations wherever asked.

Submission Format

Submit a single pdf file, having the name as your roll number. Example, **170010037.pdf.**

Deadline: 5:00 PM 24/01/2021