



Dhirubhai Ambani Institute of
Information and Communication
Technology

ADSP

LAB – 10 : IF Estimation

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EXERCISES

Question) What is spectrogram? Why it is used?

Answer

- ⇒ A **spectrogram** is a visual representation of how the frequency content of a signal changes over time.
- ⇒ It's basically a time-vs-frequency plot where:
 - X-axis = Time
 - Y-axis = Frequency
 - Color (or intensity) = Amplitude (strength) of that frequency at that time
- ⇒ Spectrograms are super useful because they give a **joint-frequency analysis** of signals – something that pure Fourier Transform (FT) can't do.

Fourier Transform	Spectrogram
Only frequency information	Time + Frequency information
Can't tell when things happen	Can see when a frequency occurs
Good for stationary signals	Better for non-stationary signals

Q1) Take 1 audio signal. Plot the spectrogram of audio signal.

CODE:

```
% 202411012
% Audio signal's spectrogram

clc; clear; close all;

% Loading the audio file

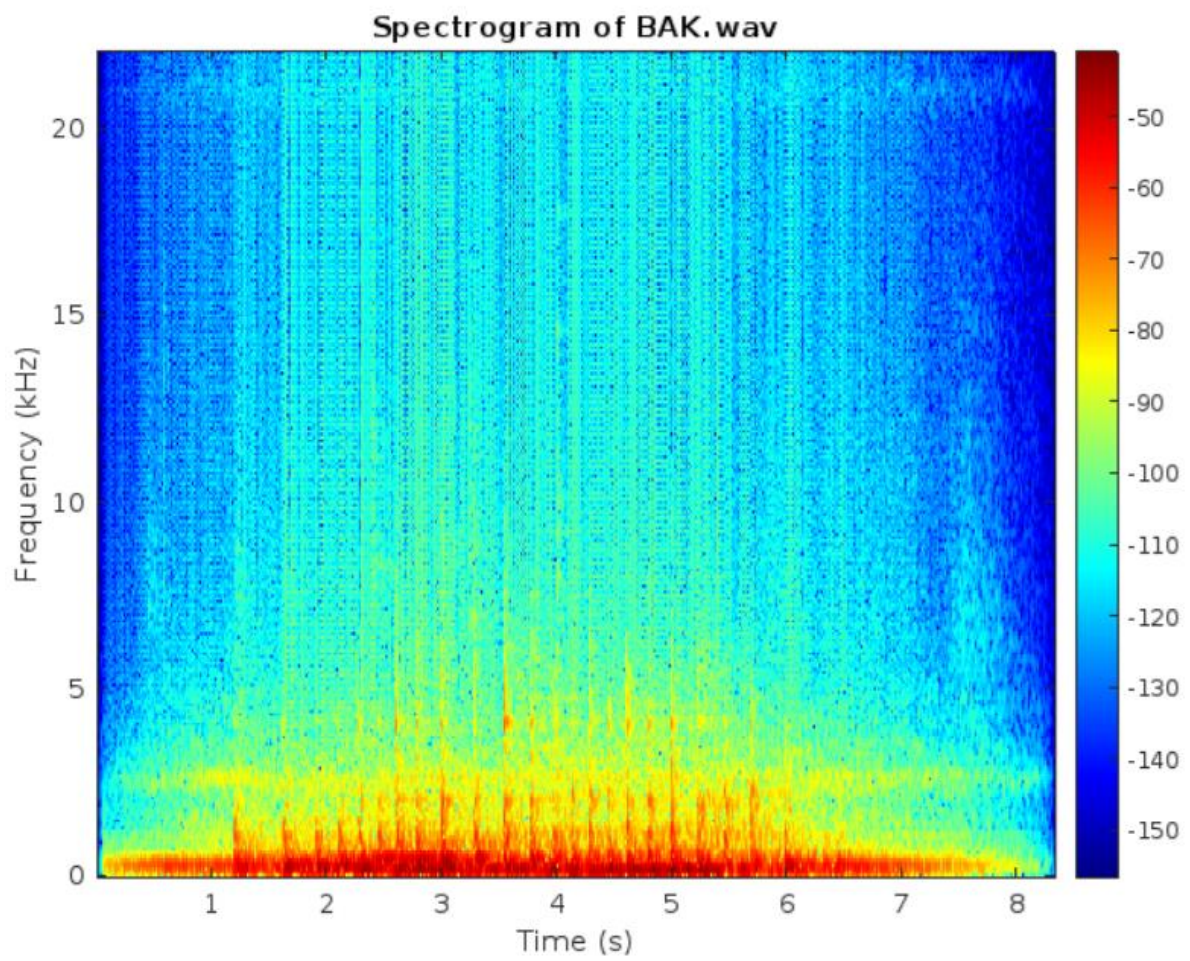
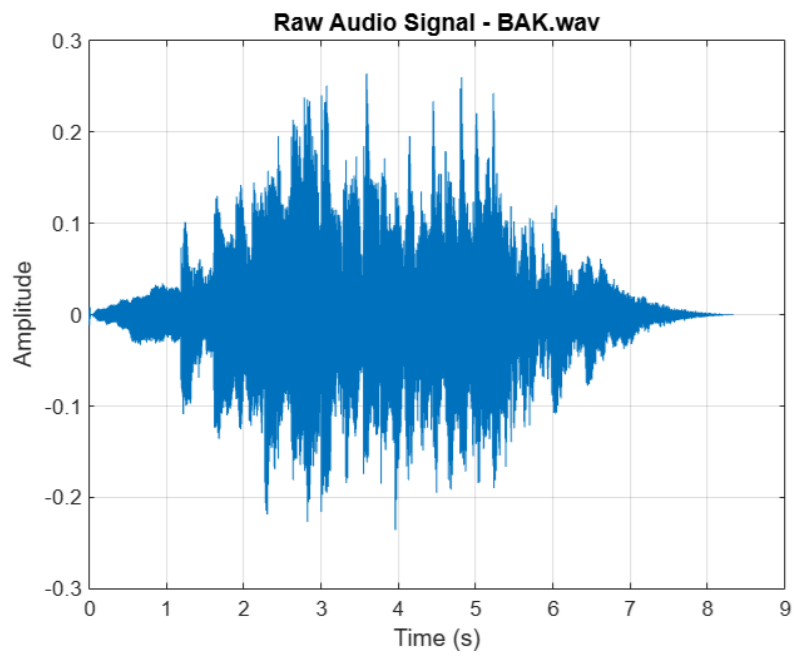
[audio, Fs] = audioread('BAK.wav'); % Fs = Sampling frequency
audio = mean(audio, 2);

% Time vector (optional, for signal plotting)
t = (0:length(audio)-1)/Fs;

% Plotting the raw waveform
figure;
plot(t, audio);
xlabel('Time (s)');
ylabel('Amplitude');
title('Raw Audio Signal - BAK.wav');
grid on;

% Spectrogram Parameters
win_length = 256; % Window length
overlap = round(0.75 * win_length); % Overlap between windows
nfft = 512; % FFT size

% Plotting the Spectrogram
figure;
spectrogram(audio, hamming(win_length), overlap, nfft, Fs, 'yaxis');
title('Spectrogram of BAK.wav');
colormap jet;
colorbar;
```



Q2) Take 1 music signal. Plot the spectrogram of music signal.

```
% 202411012
% Music signal's spectrogram

clc; clear; close all;

% Loading the audio file

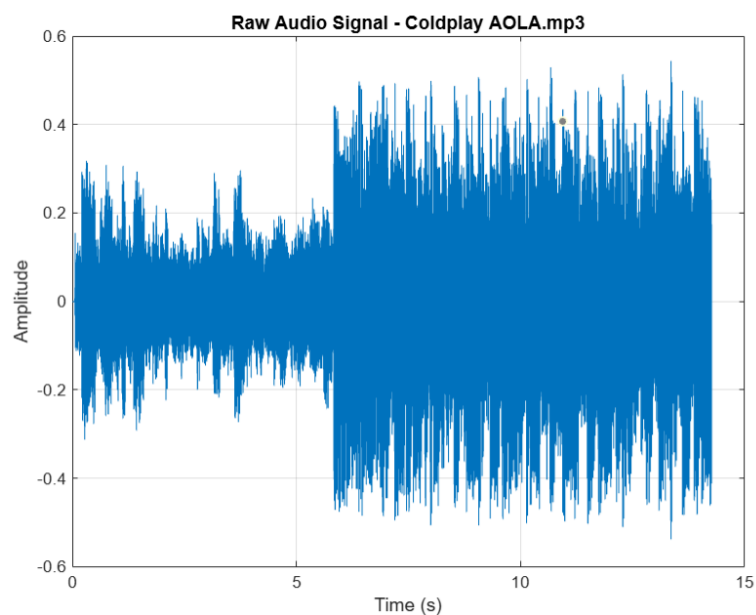
[audio, Fs] = audioread('Coldplay_AOLA_Trimmed.mp3'); % Fs = Sampling frequency
audio = mean(audio, 2);

% Time vector (optional, for signal plotting)
t = (0:length(audio)-1)/Fs;

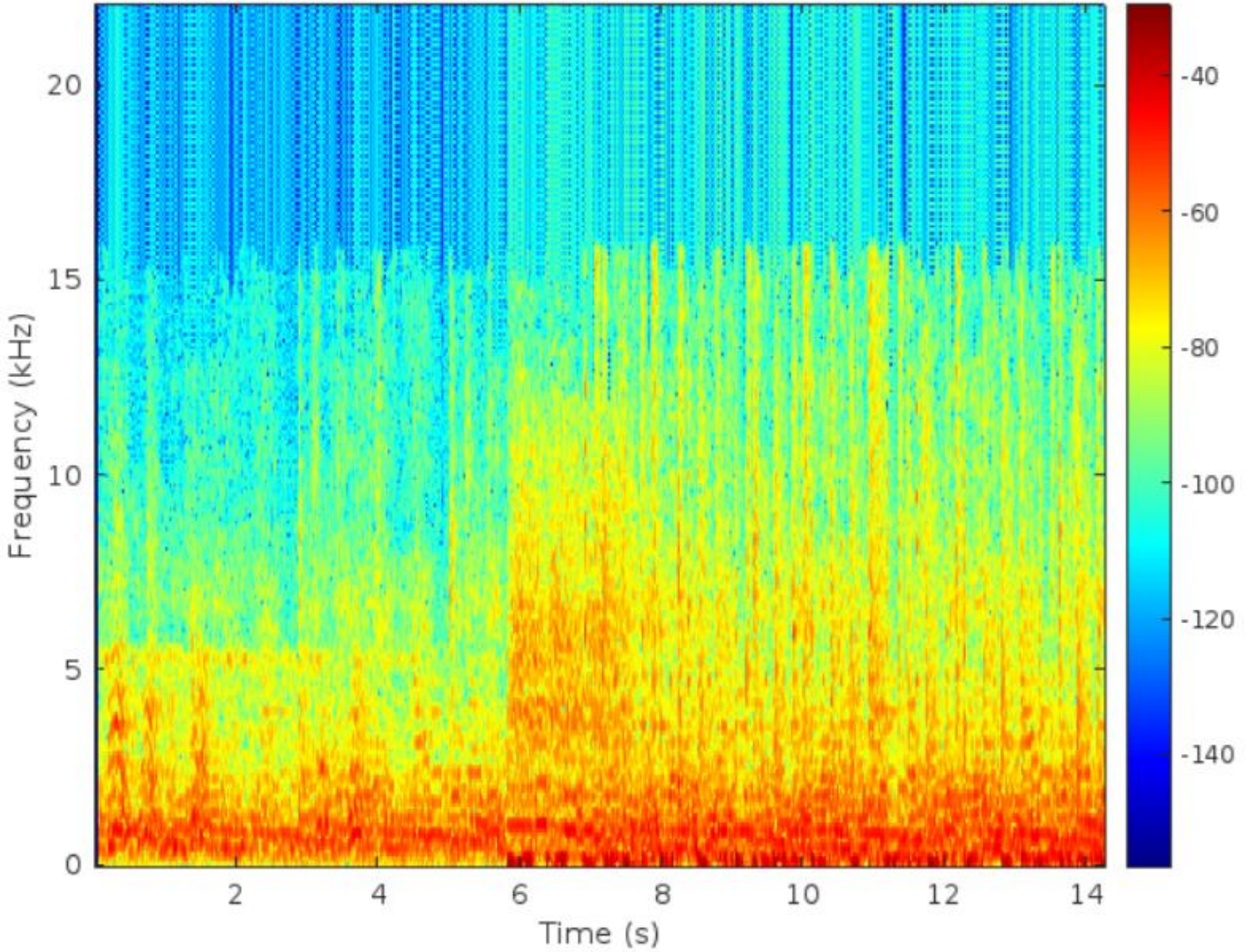
% Plotting the raw waveform
figure;
plot(t, audio);
xlabel('Time (s)');
ylabel('Amplitude');
title('Raw Audio Signal - Coldplay AOLA.mp3');
grid on;

% Spectrogram Parameters
win_length = 256; % Window length
overlap = round(0.75 * win_length); % Overlap between windows
nfft = 512; % FFT size

% Plotting the Spectrogram
figure;
spectrogram(audio, hamming(win_length), overlap, nfft, Fs, 'yaxis');
title('Spectrogram of AOLA.mp3');
colormap jet;
colorbar;
```



Spectrogram of AOL.A.mp3

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