DEPARTMENT OF

ELECTRONICS AND COMMUNICATION ENGINEERING

Faculty of Engineering and Technology

SRM Institute of Science and Technology

MINI PROJECT REPORT

ODD Semester, 2020-2021

Lab code & Sub Name: Analog and Digital Communication & 18ECC205J

Year & Semester: 3rd Year & 5th Semester

Project Title: Detection and Identification of frequency(value) in an audio

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Reg. No → / Mark split up ↓	RA18110040 10202	RA18110040 10203	RA18110040 10206
Novelty in the project work (2 marks)			
Level of understanding of the design formula (4 marks)			
Contribution to the project (2 Marks)			
Report writing (2 Marks)			
Total (10 Marks)			

OBJECTIVE:

To find the frequency components in a given mixed frequency signal where the mixed signal was recorded by playing 2 tuning forks simultaneously.

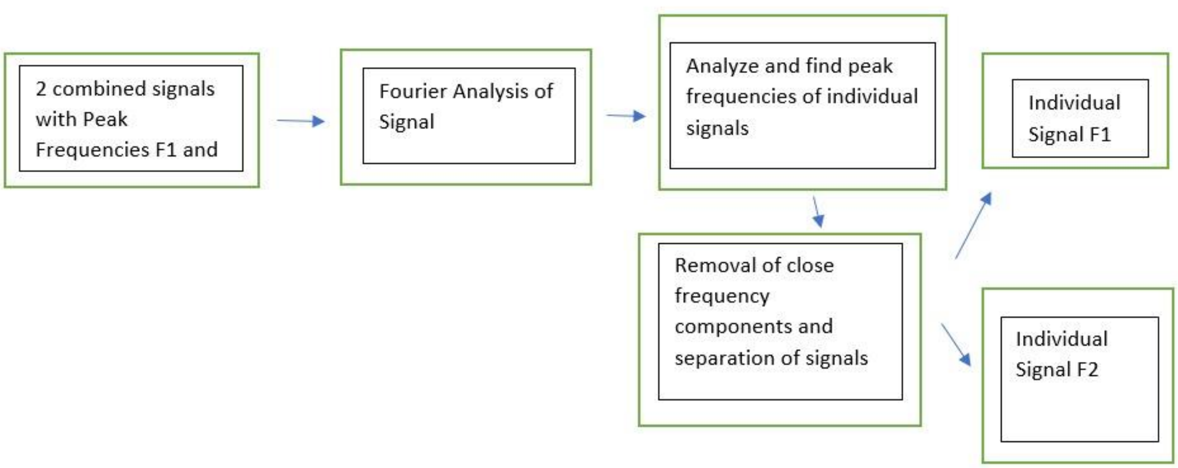
ABSTRACT:

This is based on the process of finding Fourier transform of a singular channel signal. The signal is a singular channel wav file that is fed into the program and the audio signal is read and the signal is distinguished and the components separated.

This program finds the frequency components in a given mixed frequency signal. The given code in Sci-Lab runs a given audio file and it identifies the separate frequency components. In the process of execution, it displays the different values of frequency in the audio and displays it in the end. The magnitude of the Fourier transform of the signal is calculated and plotted, after the entire program completes execution the different frequency components are displayed, i.e., the value of the frequency. This is also applicable for singular frequency audios. Hence, through this program you can identify the different frequency components in an audio and find out its respective values.

There can be many advantages of using such a mechanism, the signal can be differentiated and analysed. The signals frequency components can be found and displayed. All the noise can be cleared and a pure tone can be obtained.

BLOCK DIAGRAM:



HARDWARE/SOFTWARE REQUIREMENTS:

Sci-Lab Software, Audio File (.wav format)

METHODOLOGY:

We try to detect the individual frequencies of the waves by finding the fast Fourier transform (FFT) of the given audio file. Then, we plot a frequency response graph and find the individual peak frequencies of the given signals, which can be noticed in the graph, with 2 individual peak frequencies shown, which are the peak frequency values of the two tuning forks. Now, these signal frequency values are sorted and values close to each other are removed, thereby allowing us to get a pure signal without noise.

WORKING CODE:

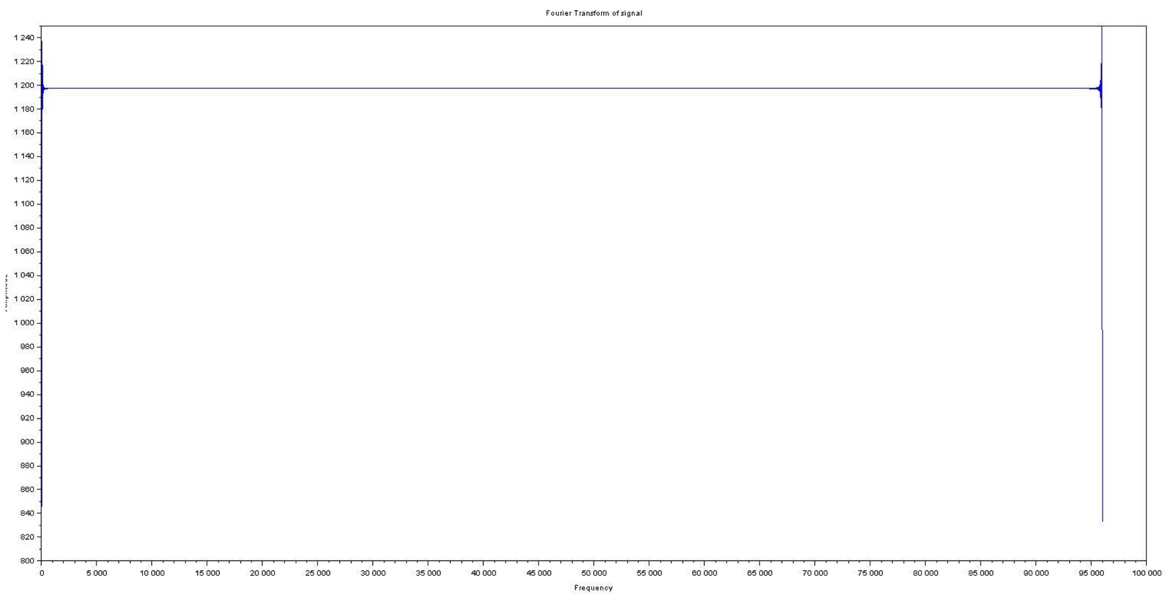
DSP Mini Project.sce (C:\Users\dhruv\DSP Mini Project.sce) - SciNotes

*DSP Mini Project.sce

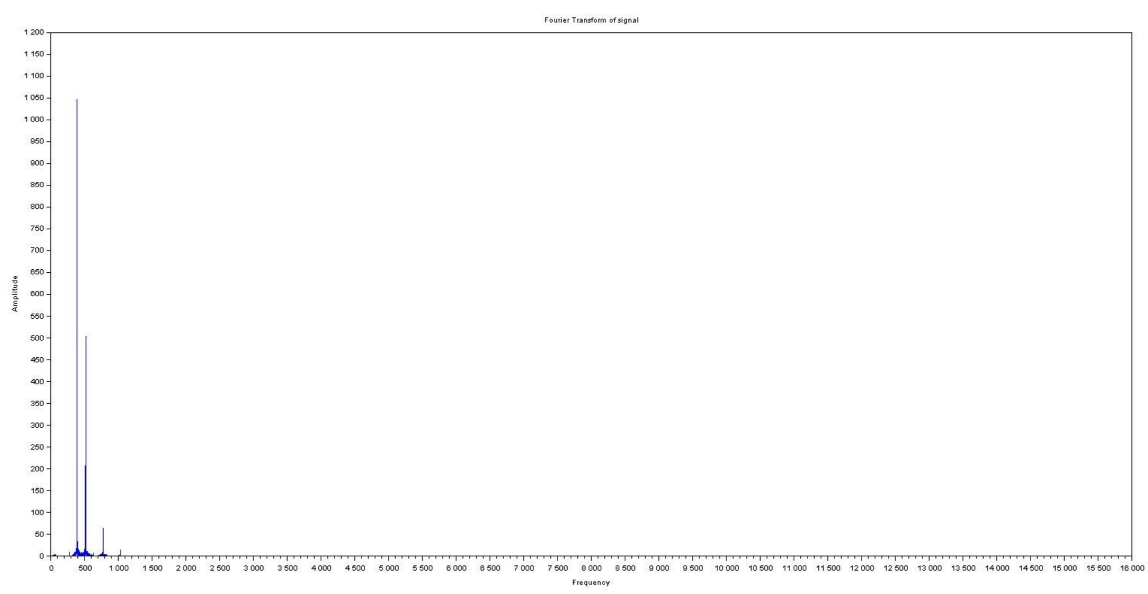
```
// This program finds the frequency components in a given mixed frequency signal
// Mixed frequency signal was recorded by playing 2 Tunng forks simultaneously
clc;
close;
clear;

[y,Fs] = wavread('C:\Users\dhruv\Desktop\DSP Mini Project\Mixed512and384.wav'); //read the audio file

Y=abs(fft(y));  //find the fourier transform

l = length(Y)/2;
f = (0:(l-1))*Fs/(2*l); //modify the x axis to represent frequency instead of samples

abs_fft = abs(Y(1:l));
plot(f,abs_fft);   //plot magnitude of fourier transform
title('Fourier Transform of signal')
xlabel('Frequency')
ylabel('Amplitude')

peak = max(abs_fft); //find the first maxima of the spectrum
secpeak = max(abs_fft(abs_fft<max(abs_fft)));  //find the second maxima of the spectrum
peakfreq = [f(abs_fft == peak), f(abs_fft == secpeak)];   //find the frequency corresponding to the peaks
peakfreq = gsort(peakfreq); //sort the detected frequencies
peakfreq(abs(max(peakfreq) - max(peakfreq(peakfreq<max(peakfreq)))) < 10) = []; //remove frequencies that are very close to one another

disp('Given signal has following frequencies (in Hz): ');
disp(peakfreq); //display the contained frequencies

```

OUTPUT:

Graphical Output for audio file (Freq1.wav):



Graphical Output for audio file (Mixed512and384.wav):



Numerical Output for above audio files respectively:

```
Scilab 6.0.2 Console

Startup execution:
  loading initial environment

--> exec('C:\Users\dhruv\DSP Mini Project.sce', -1)

 Given signal has following frequencies (in Hz):

   511.5   384.

--> exec('C:\Users\dhruv\DSP Mini Project.sce', -1)

 Given signal has following frequencies (in Hz):

   95939.717
```

CONCLUSION:

The frequency components of the given mixed frequency signals were obtained and their graphs were plotted successfully.

References:

https://www.researchgate.net/publication/328041291_A_New_Frequency_Detection_Method_Based_on_FFT_in_the_Application_of_SAW_Resonator_Sensor

Methods	Sampling Frequency	Frequency Deviation	Time	Range
FFT	60 MHz	9500 Hz	0.66 ms	0-5 MHz
FFT-ZP (16 bit)	60 MHz	753.14 Hz	1.08 ms	0-5 MHz
FFT-ZP (16 bit) with Noise	60 MHz	925.48 Hz	1.08 ms	0-5 MHz
FFT-ZP (24 bit) with Noise	60 MHz	376 Hz	700 ms	0-5 MHz
Zero Crossing	60 MHz	1500000 Hz	0.02 ms	0-5 MHz
ZC-Linear	60 MHz	1140 Hz	8.2 ms	1-5 MHz
ZC-Linear with Noise	60 MHz	1420 Hz	8.2 ms	1-5 MHz
Searching Algorithm	60 MHz	21830 Hz	1700 ms	1-5 MHz