

## FFT WITH MIT APP INVENTOR 2 – TUTORIAL

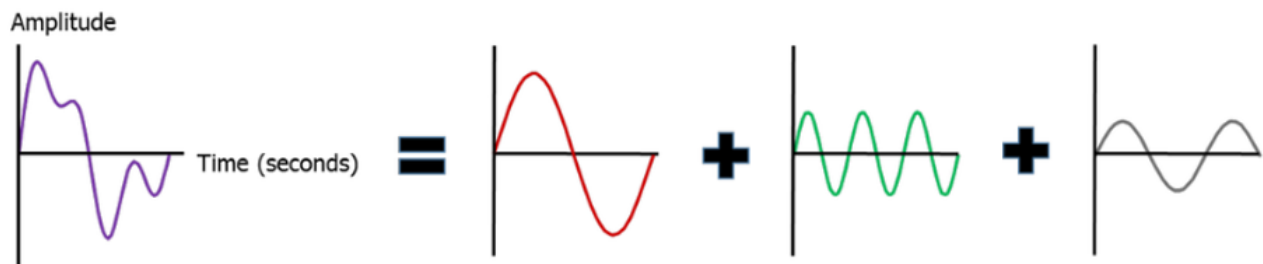
<https://github.com/steluis/FFT-With-APP-INVENTOR->

### WHAT IS FOURIER TRANSFORM

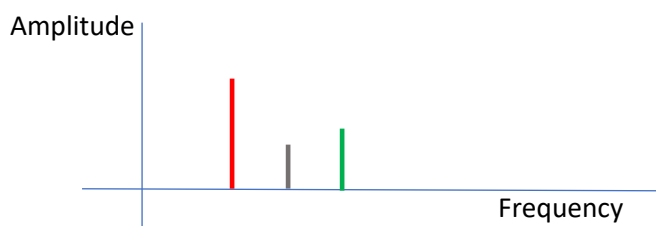
The Fourier Transform is a mathematical tool used to transform a time domain signal into the frequency domain.

The base concept of the Fourier Transform is that any signal in time domain can be represented as a series of sine waves of different frequency, amplitude and phase.

Let me show you an example. The signal on the left can be represented as the sum of three sinusoids, each of different amplitude, frequency and phase.



To simplify, we can represent the three sinusoids in a single graph where in the x-axis we put the frequency and in the y-axis the amplitude of the sinusoid



This graph represents the signal in the frequency domain and is also called spectrum. The three vertical lines, of different amplitude, represent the three sinusoids in which the signal can be decomposed.

## WHAT IS FAST FOURIER TRANSFORM (FFT)

FFT is an algorithm that can be easily implemented in a computer to obtain the frequency domain of any signal in the time domain.

In our case the signal that we are going to decompose in the frequency domain is the signal coming from the microphone of our smartphone.

## HOW FFT IS IMPLEMENTED IN AI2

The extension for App Inventor 2 that allows to implement the FFT is called AI2\_FFT.

Like all other components, this extension has **methods, events and properties**.

Let's see them briefly before moving on to an example.

**Call AI2\_FFT.Start** → Start the capture of audio signal from the microphone to be processed.

**Call AI2\_FFT.Stop** → Stop the capture of audio signal from the microphone.

**Set AI2\_FFT.freq** → Set the frequency to capture the amplitude.

**AI2\_FFT.PeakPos** → Get the frequency of the main signal.

**AI2\_FFT.Magnitude** → Get the amplitude of the harmonic at the frequency set with AI2\_FFT.freq.

## EXAMPLE 1 – GET THE FREQUENCY OF THE MAIN SIGNAL

In this first tutorial I'll show you how to get the frequency of the main signal captured by the microphone.

Open MIT AI2 and create a new project.

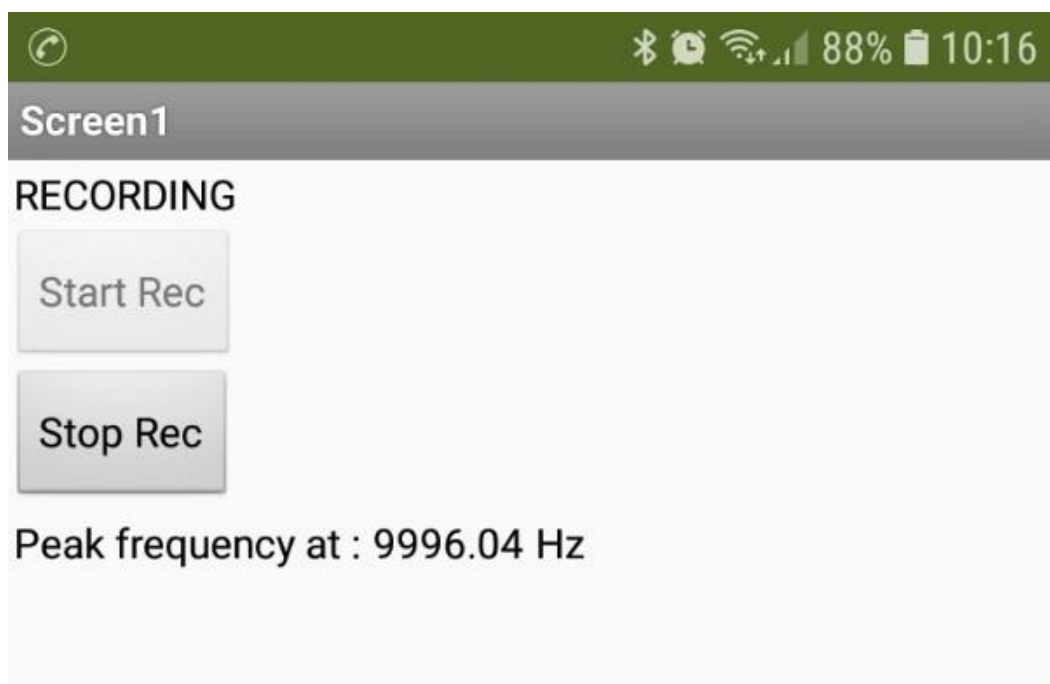
Import the first example selecting My Projects → Import project (.aia) from my computer ... → Select file named FFTTest1.aia and import the project

This example is quite simple. Pushing Start Rec the recording of audio signal coming from the microphone is activated and every second the value of the peak frequency is updated.

You can test that it works opening a Youtube video with test frequencies. i.e. at the following link it plays 10.000Hz test frequency

<https://www.youtube.com/watch?v=cjUKmG4WLpQ&t=350s>

Put your mobile phone close to the loudspeakers of the PC, push Start Rec and you should get something like that :



## EXAMPLE 2 – DISPLAY THE WHOLE SPECTRUM 0Hz to 20kHz

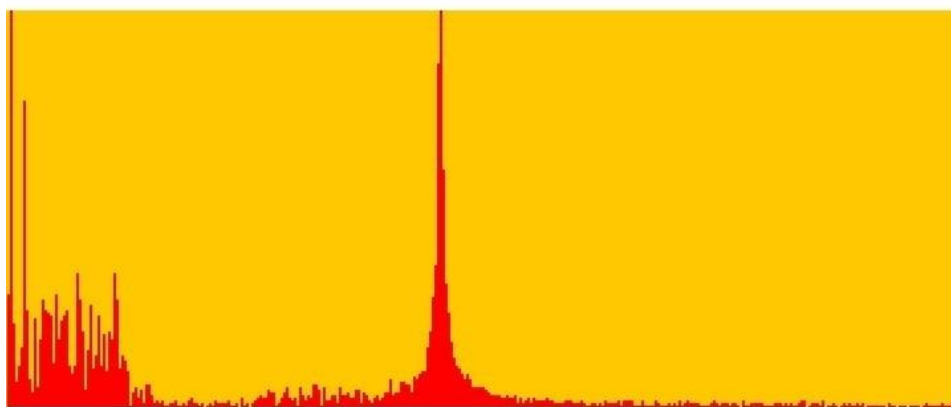
In this tutorial we will display the whole spectrum of the signal.

Open MIT and create a new project.

Import the second example selecting My Projects → Import project (.aia) from my computer ... → Select file named FourierTest.aia and import the project

Push the start button and the whole spectrum is shown, refreshed every 4 seconds.

You can again open the same link of the example above with the 10KHz test frequency and you will get something similar to that :



Frequency

The peak at 10KHz is clearly visible, the rest is noise coming from the environment and the fan of the PC.