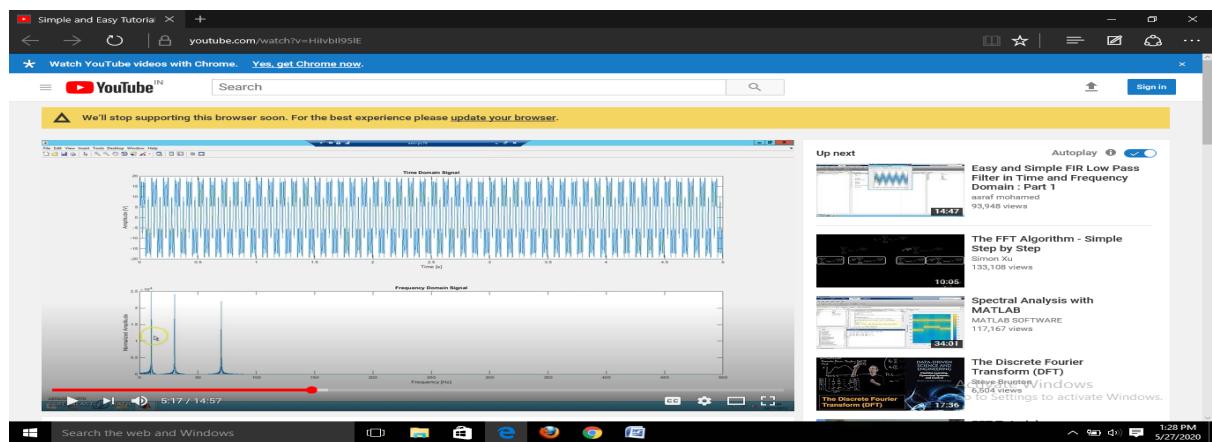
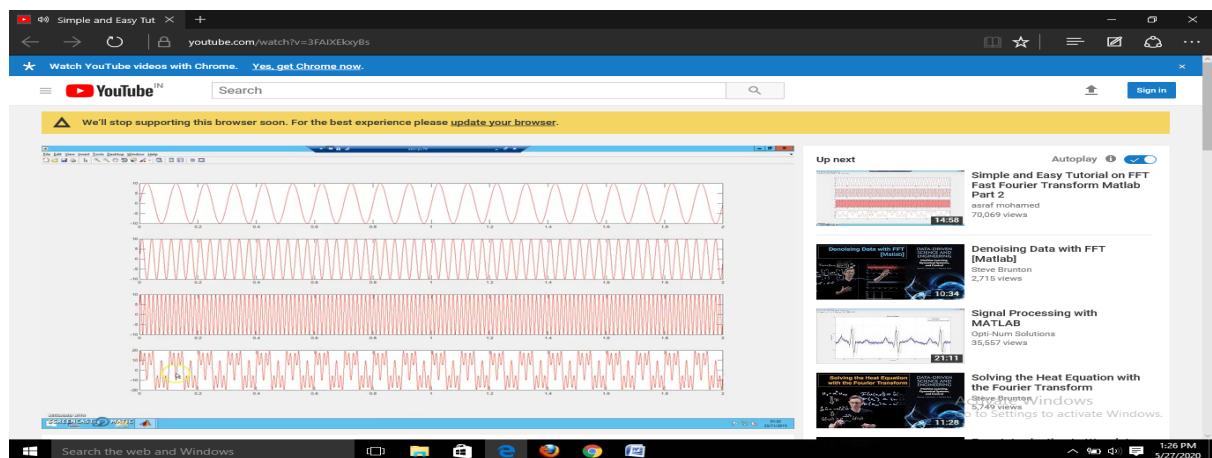
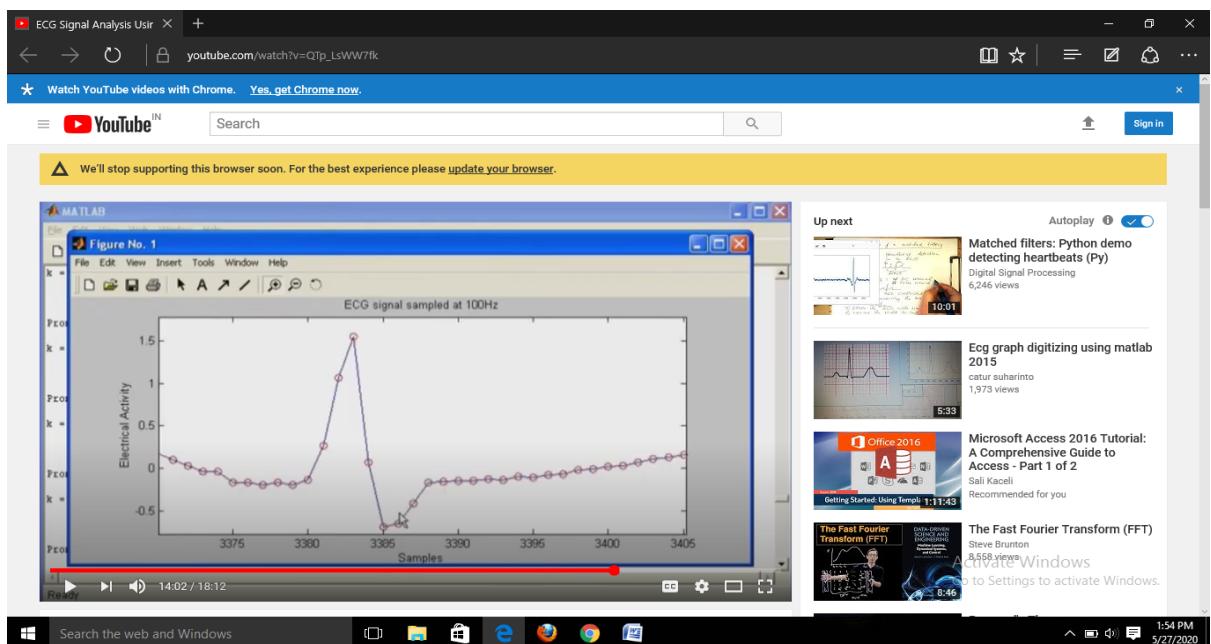
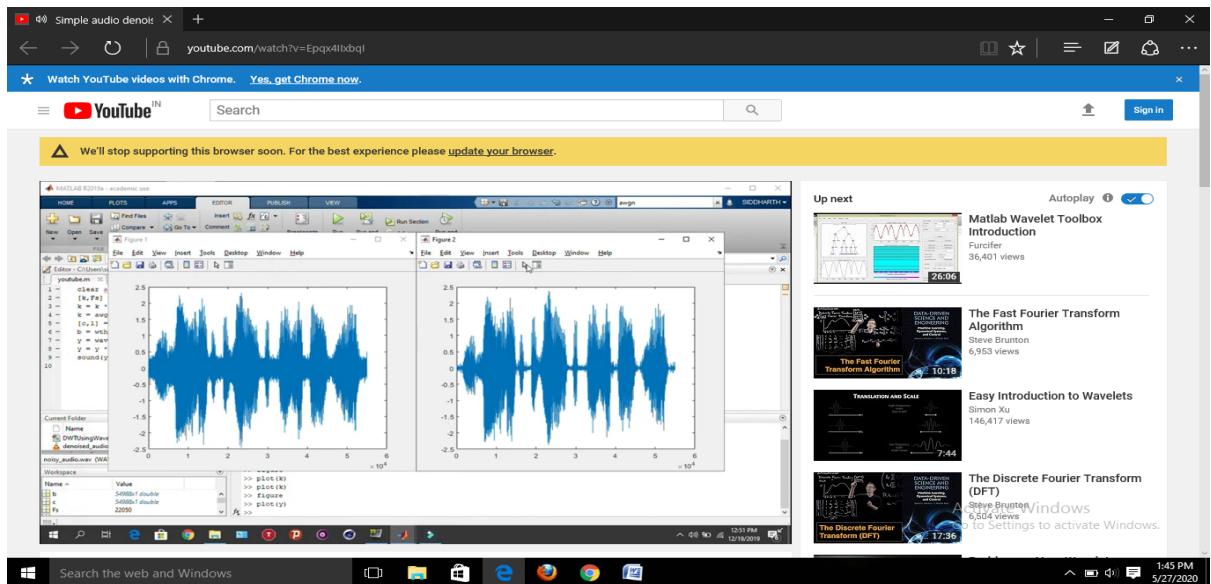
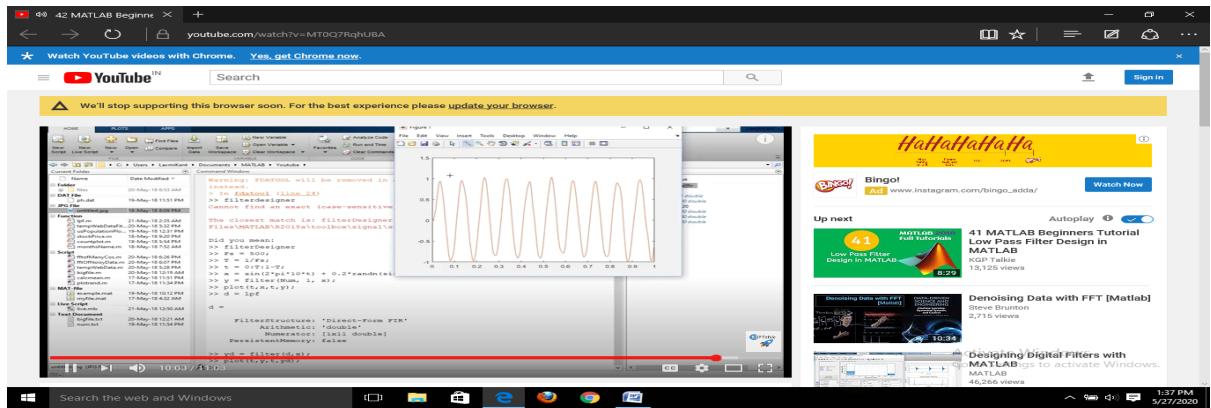


|                    |  |                      |                                 |
|--------------------|--|----------------------|---------------------------------|
| Date:              | 27-05-2020   | Name:                | Yamunashree N                   |
| Course:            | Digital signal processing  | USN:                 | 4AL17EC097                      |
| Topic:             | FFT, FFT Fast Fourier Transform Matlab, FIR and IIR Filters, Study and analysis FIR and IIR using FDA tool in MatLab, Introduction to WT, CWT & DWT, Implementation of signal Filtering signal using WT in MatLAB, Short-time Fourier Transform and the Spectrogram, Welch's method and windowing, ECG Signal Analysis Using MATLAB. | Semester and section | 6 <sup>th</sup> sem 'B' section |
| Github repository: | yamunashree-course   |                      |                                 |







27/05/2020

## Digital Signal Processing

Day - 3

### Fourier Transform

The function  $F(s)$  is defined by

$$F(s) = \int_{-\infty}^{\infty} f(x) \cdot e^{isx} dx$$

is called Fourier Transform of  $f(x)$

Also the fun  $f(x)$  defined by

$$f(x) = \frac{1}{2\pi} \int_{-\infty}^{\infty} F(s) \cdot e^{-isx} ds$$

is called i) Inverse Fourier Transform  
of  $F(s)$  or ii) Inversion Formula

### FFT

$$x_p = \sum_{n=0}^{N-1} x_n \cdot w_N^{np} \quad 0 \leq p \leq N-1$$

$w_N \triangleq e^{-j \frac{2\pi}{N}}$

$$X_0 = x_0 + x_1 + x_2 + x_3$$

Inputs to

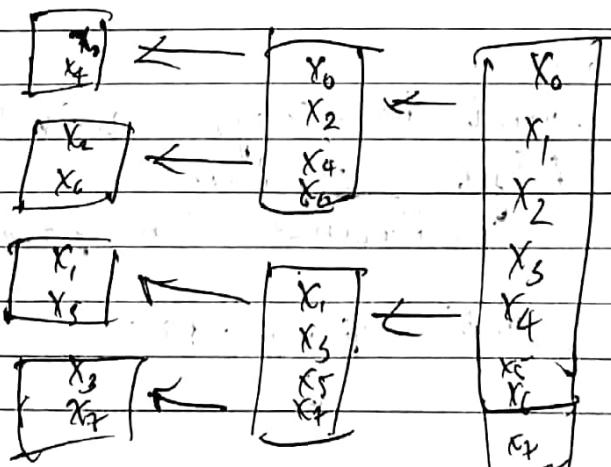
2-point DFTs

Inputs to

4-point DFTs

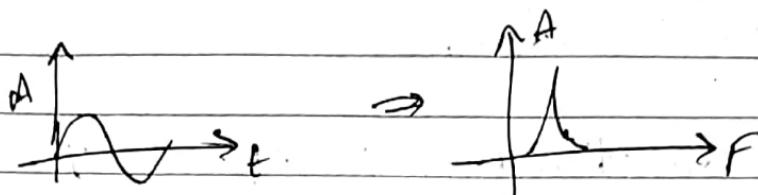
Inputs to

8-point DFTs



## \* FFT fast fourier Transform Matlab

FFT



## FIR and IIR Filters

FIR filter

- consider system described by the transfer function

$$H(z) = \frac{b_3 z^3 + b_2 z^2 + b_1 z + b_0}{z^3}$$

- The corresponding Diff Eqn

$$y[k] = b_3 f[k] + b_2 f[k-1] + b_1 f[k-2] + b_0 f[k-3]$$

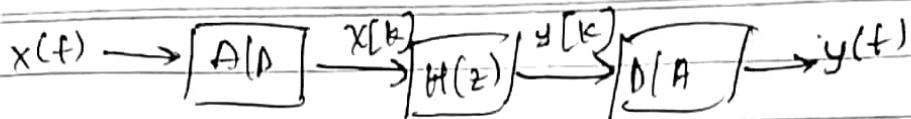
Show the current output is a function of current & past inputs

- FIR filters only have poles at the origin

## Introduction

- we want to design equivalent Digital systems
- continuous-time system

$$x(t) \rightarrow H(w) \rightarrow y(t)$$



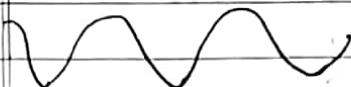
Equivalent Discrete-time System.

- Input to  $H(z)$  is  $x[k] = X(kT)$
- Output of  $H(z)$  is  $y[k] = Y(kT)$

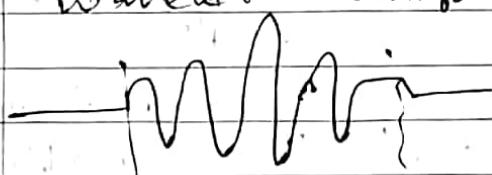
Study and Analysis FIR and IIR using FPA tool in Matlab

Introduction to WT

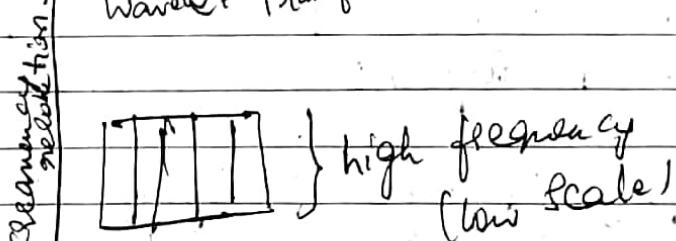
FT



wavelet Transform



Resolution  
Wavelet Transform



CWT and DWT

Faster Period

$$f(t) = \frac{1}{2} a_0 + t \sum_{k=1}^{\infty} (a_k \cos 2\pi k t + b_k \sin 2\pi k t)$$

$$X(F) = \int_{-\infty}^{\infty} x(t) e^{-j2\pi F t} dt$$



### Discrete Fourier Transform

continuous  $X(F) = \int_{-\infty}^{\infty} x(t) e^{-j2\pi F t} dt$

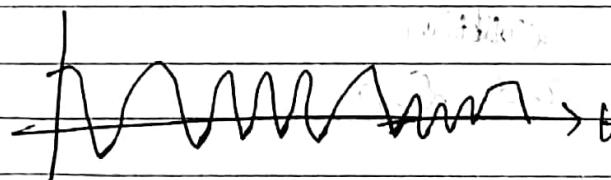
discrete  $X_k = \sum_{n=0}^{N-1} x_n \cdot e^{-j2\pi k n / N}$

evaluating at  $n$  of  $N$  samples

★ Implementation of Signal filtering  
signal using iwt in matlab

★ Short-time fourier transform and  
the Spectrogram:

Analysis of time-varying spectral characteristics  
 » Speech, music, seismology



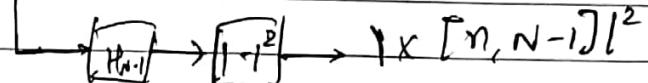
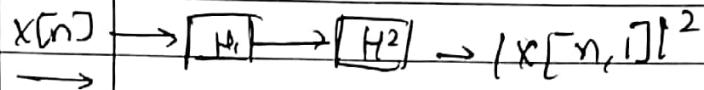
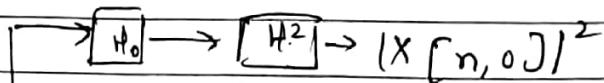
Apply DFT to windowed segment  
 of abba

Display DFT co-efficients as a function of time and frequency.

Inverse STFT:

$$x[n+m] = \frac{1}{Nw[m]} \sum_{k=0}^{N-1} X[n, k] e^{j \frac{2\pi}{N} km}$$

Filter Bank Interpretation



\* welch's method and windowing

$$w[n] \xrightarrow{\sigma^2=1} w(e^{j\omega}) \rightarrow z[n]$$

$$\delta_{xx}(\omega) = |H(e^{j\omega})|^2$$

$$\delta_{xx}(f) = |H(e^{j2\pi f - \phi_s})|^2$$

\* ECG Signal Analysis using matlab

|                |   |                              |                               |
|----------------|---|------------------------------|-------------------------------|
| <b>Date:</b>   | 27-05-2020  | <b>Name:</b>                 | Yamunashree N                 |
| <b>Course:</b> | Python programming  | <b>USN:</b>                  | 4AL17EC097                    |
| <b>Topic:</b>  | Graphical user interfaces with Tkinter & interacting with database. | <b>Semester and section:</b> | 6 <sup>th</sup> sem and B sec |

170. Setting up a GUI with Widgets

```
script1.py — D:\pp\tkinter section — Atom
File Edit Selection Find Go to line Help
tkinter section script1.py
script1.py
1 from tkinter import *
2
3 window=tk()
4
5 e1=Entry(window)
6 e1.grid(row=0,column=0)
7
8 t1=Text(window,height=1,width=20)
9 t1.grid(row=0,column=1)
10
11 window.mainloop()
12
13
14
15
```

PS D:\pp\tkinter section> python .\script1.py  
PS D:\pp\tkinter section> python .\script1.py

Activate Windows  
Go to Settings to activate Windows.

171. Connecting GUI Widgets with Callback Functions

```
script1.py — D:\pp\tkinter section — Atom
File Edit Selection Find Go to line Help
tkinter section script1.py
script1.py
1 from tkinter import *
2
3 window=Tk()
4
5 def km_to_miles():
6     miles=float(e1_value.get())*1.6
7     t1.insert(END,miles)
8
9 b1=Button(window,text="Execute",command=km_to_miles)
10 b1.grid(row=0,column=0)
11
12 e1_value=StringVar()
13 e1=Entry(window,textvariable=e1_value)
14 e1.grid(row=0,column=1)
15
16 t1=Text(window,height=1,width=20)
17 t1.grid(row=0,column=2)
18
19 window.mainloop()
```

```
File "C:\Users\Marius.Grete-PC\AppData\Local\Programs\Python\Python35-32\lib\tkinter\__init__.py", line 1549, in __call__
    return self.func(*args)
File ".\script1.py", line 7, in km_to_miles
    miles=e1_value.get()*1.6
TypeError: can't multiply sequence by non-int of type 'float'
PS D:\pp\tkinter section> python .\script1.py
10
PS D:\pp\tkinter section>
```

Activate Windows  
Go to Settings to activate Windows.

# Solution

```
1  from tkinter import *
2
3  # Create an empty Tkinter window
4  window=Tk()
5
6  def from_kg():
7      # Get user value from input box and multiply by 1000 to get kilo
8      gram=float(e2_value.get())*1000
9
10     # Get user value from input box and multiply by 2.20462 to get pounds
11     pound=float(e2_value.get())*2.20462
12
13     # Get user value from input box and multiply by 35.274 to get ounces
14     ounce=float(e2_value.get())*35.274
15
16     # Empty the Text boxes if they had text from the previous use and
17     t1.delete("1.0", END) # Deletes the content of the Text box from
18     t1.insert(END,gram) # Fill in the text box with the value of gram
19     t2.delete("1.0", END)
20     t2.insert(END,pound)
21     t3.delete("1.0", END)
22     t3.insert(END,ounce)
23
24     # Create a Label widget with "Kg" as label
25     e1=Label(window,text="Kg")
26     e1.grid(row=0,column=0) # The Label is placed in position 0, 0 in the
27
28     e2_value=StringVar() # Create a special StringVar object
29     e2=Entry(window,textvariable=e2_value) # Create an Entry box for user
30     e2.grid(row=0,column=1)
31
32     # Create a button widget
33     # The from_kg() function is called when the button is pushed
34     b1=Button(window,text="Convert",command=from_kg)
```

Activate Windows  
Go to Settings to activate Windows.





27/05/2020

Day-8

Graphical user interfaces with Tkinter and interacting with databases.

- \* Introduction to Tkinter
- \* Setting up a GUI with widgets
- \* Connecting GUI widgets with Callback Functions
- \* Create a multi-widget GUI
- \* ~~Solution~~