

EE3025 ASSIGNMENT- 1

PEDAVEGI ADITYA - EE18BTECH11034

Download all python codes from

<https://github.com/adi2000pedavegi/ee3025-idp/tree/master/Assignment-1-fft/codes>

and latex-tikz codes from

<https://github.com/adi2000pedavegi/ee3025-idp/tree/master/Assignment-1-fft>

From the coefficients b,a and from (2.0.4) evaluating $H(K)$

$$X(k) = \text{fft}(x(n)) \quad (2.0.5)$$

From that

$$Y(K) = H(K) X(K) \quad (2.0.6)$$

$$y(n) = \text{fft}(Y(K)) \quad (2.0.7)$$

The command

```
output_signal = signal.lfilter(b,a,
                                output_signal)
```

in Problem 2.3 is executed through following difference equation

$$\sum_{m=0}^M a(m) y(n-m) = \sum_{k=0}^N b(k) x(n-k) \quad (1.0.1)$$

where input signal is $x(n)$ and output signal is $y(n)$ with initial values all 0. Replace **signal.filtfilt** with your own routine and verify

2 SOLUTION

Using the properties of z-transform

$$\mathcal{Z}\{x(n-k)\} = z^{-k} X(z) \quad (2.0.1)$$

$$\mathcal{Z}\{y(n-m)\} = z^{-m} Y(z) \quad (2.0.2)$$

where $X(z)$ and $Y(z)$ are the respective z-transforms of $x(n)$ and $y(n)$ respectively.

Converting the difference equation into its z-transform equation

$$Y(z) \sum_{m=0}^M a(m) z^{-m} = X(z) \sum_{k=0}^N b(k) z^{-k} \quad (2.0.3)$$

$$H(z) = \frac{Y(z)}{X(z)} = \frac{\sum_{k=0}^N b(k) z^{-k}}{\sum_{m=0}^M a(m) z^{-m}} \quad (2.0.4)$$

where $y(n)$ is time domain output signal

3 COMPUTING USING FFT ALGORITHM IN BOTH PYTHON

Below is the following python code implementing fft algorithm in python

codes/ee18btech11034-fft.py

Plotting the time domain output signal obtained from fft in python and constructing the audio file Below is the audio file for the above output $y(n)$

codes/7.1
_Sound_With_ReducedNoise_using_python
.wav

4 COMPUTING USING FFT ALGORITHM IN C

Storing the input signal $x(n)$ and transfer function $H(z)$ in .dat files for loading into C code Below is the following python code for storing the data

codes/ee18btech11034-fft-data.py

Executing the following code in C to get output $y(n)$

codes/ee18btech11034-fft.c

Plotting the time domain output signal obtained from fft in C and constructing audio file

codes/ee18btech11034-fft-output.py

Below is the audio file for the above output $y(n)$

codes/7.1 _Sound_With_ReducedNoise_using_c.
wav

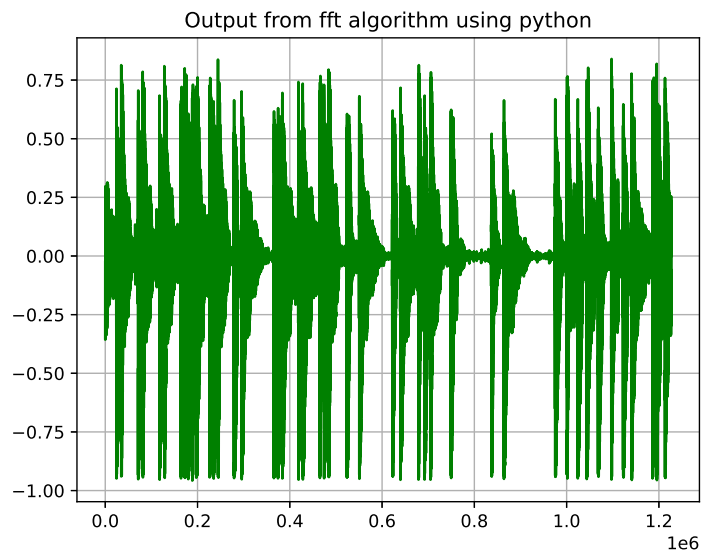


Fig. 0: Time domain response

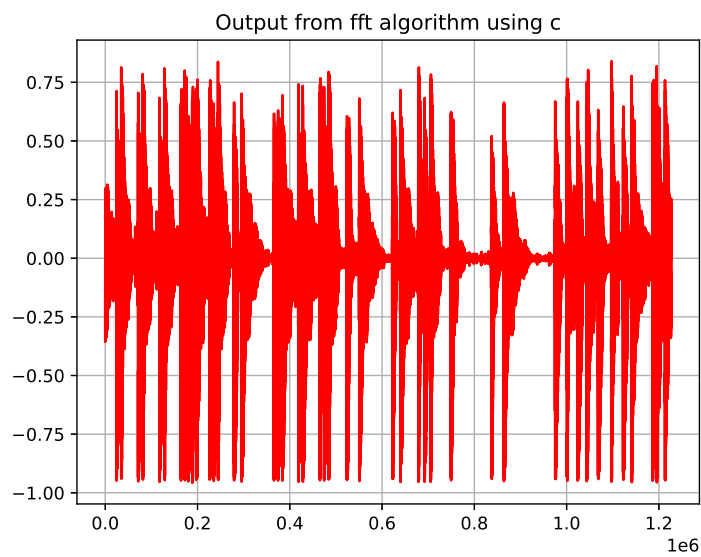


Fig. 0: Time domain response