EE3025 Assignment-1

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Download all python codes from

https://github.com/Shreshta126/EE3025−IDP/tree/main/Assignment1/codes

and latex-tikz codes from

https://github.com/Shreshta126/EE3025−IDP/blob/main/Assignment1/ee18btech11041.pdf

1 Problem

The command

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

in Problem 2.3 is executed through following difference equation

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

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

2 Solution

Shifting property of z-transform

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

where $X(z)$ is the Z- transform of x(n) and u is constant.

Applying Z-transform on both sides of the eq.(1.0.1) and using the above property:

$$\sum_{m=0}^{M} a(m)\, Y(z)\, z^{-m} = \sum_{k=0}^{N} b(k)\, X(z)\, z^{-k} \tag{2.0.2}$$

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

The coefficients a,b are abtained by passing x(n) through the low pass filter.

Taking **fft** of x(n) and multiplying it by $H(e^{j\omega})$ we get $Y(e^{j\omega})$. Taking **ifft** of $Y(e^{j\omega})$ we get y(n).

Python code for the problem

codes/ee18btech11041.py

Below are the plots which verifies our own routine

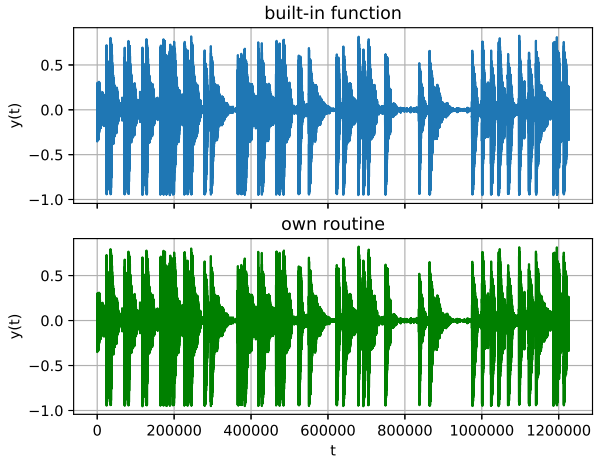

Fig. 0: Time response

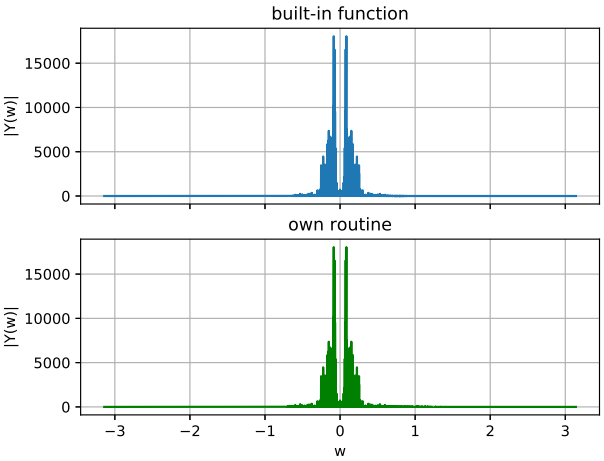

Fig. 0: Frequency response