

EE3025 Assignment-1

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Download all python codes from

<https://github.com/Rishithapawar/EE3025/tree/master/Assignment-1/codes>

and latex-tikz codes from

<https://github.com/Rishithapawar/EE3025/tree/master/Assignment-1>

1 PROBLEM

The command

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

in Problem 2.3 is executed through following difference equation

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

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

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

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

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

Using built in fft command evaluating $X(K)$ from $x(n)$
From

$$Y(K) = H(K) X(K) \quad (2.0.5)$$

Using built in ifft command evaluating $y(n)$ from $Y(K)$

Below is the following python code for the above question

`codes/ee18btech11033.py`

Below is the soundfile constructed from output signal y using own routine filter

`codes/Sound_With_ReducedNoise_7.1.wav`

3 VERIFICATION

Plotting the time domain output signal evaluated from both own routine filter and signal.filtfilt command 0

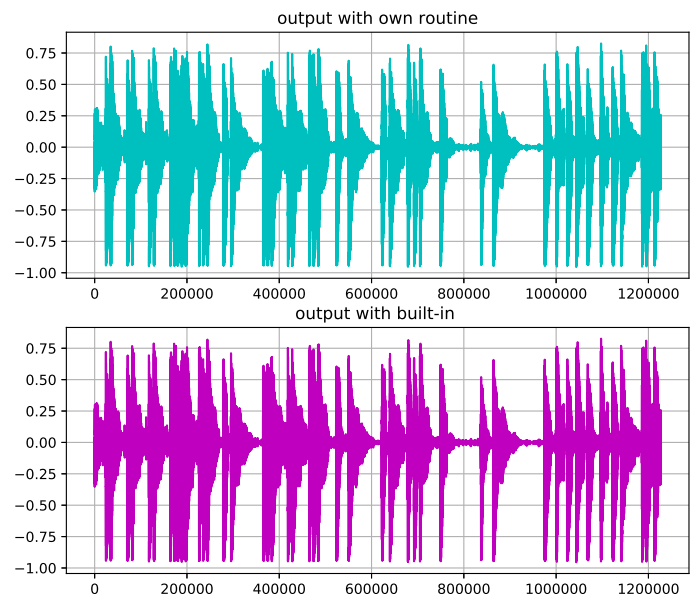


Fig. 0: Time domain response

Plotting the frequency domain response evaluated
from both own routine and signal.filtfilt 0

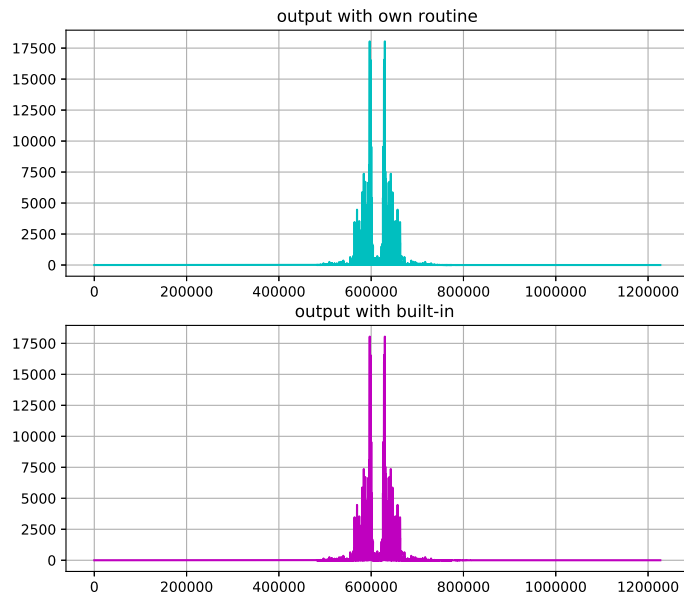


Fig. 0: Frequency domain response