EE3025 Assignment-1

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Download all python codes from

https://github.com/dks2000dks/IIT−Hyderabad−Semester−Courses/tree/master/EE3015−EE3025/Assignment−1/Part−1/Report/codes

and latex-tikz codes from

https://github.com/dks2000dks/IIT−Hyderabad−Semester−Courses/tree/master/EE3015−EE3025/Assignment−1/Part−1/Report

1 Problem

1.1. Let

$$x(n) = \left\{ \underset{\uparrow}{1}, 2, 3, 4, 2, 1 \right\} \quad (1.1.1)$$

$$y(n) + \frac{1}{2}y(n-1) = x(n) + x(n-2) \quad (1.1.2)$$

1.2. Compute X(k), H(k) and y(n) using FFT and IFFT

2 Solution

2.1.

$$x(n) = \left\{ \underset{\uparrow}{1}, 2, 3, 4, 2, 1 \right\} \quad (2.1.1)$$

$$y(n) + \frac{1}{2}y(n-1) = x(n) + x(n-2) \quad (2.1.2)$$

Impulse Response of the LTI system is the output of the system when Unit Impulse Signal is given as input to the system.

So, Impulse Response of the System is

$$h(n) + \frac{1}{2}h(n-1) = \delta(n) + \delta(n-2) \quad (2.1.3)$$

$h(n)$ is an IIR Filter.

2.2. FFT of a Input Signal $x(n)$ is

$$X(k) = \sum_{n=0}^{N-1} x(n)e^{-j2\pi kn/N}, \quad k = 0, 1, \ldots, N-1 \quad (2.2.1)$$

2.3. FFT of a Impulse Response $h(n)$ is

$$H(k) = \sum_{n=0}^{N-1} h(n)e^{-j2\pi kn/N}, \quad k = 0, 1, \ldots, N-1 \quad (2.3.1)$$

2.4. then FFT of output Signal $y(n)$ can be computed by

$$Y(k) = X(k)H(k) \quad (2.4.1)$$

2.5. $y(n)$ can be computed by doing IFFT for $Y(k)$

$$y(n) = \frac{1}{N}\sum_{n=0}^{N-1} Y(k)e^{j2\pi nk/N}, \quad k = 0, 1, \ldots, N-1 \quad (2.5.1)$$

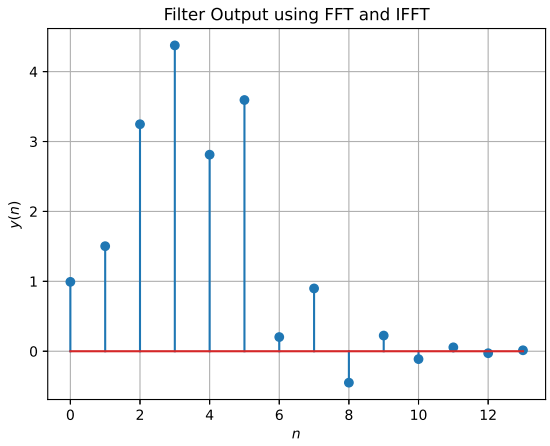

Fig. 2.5: output signal y(n)