

# 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>

$$H(z) = \frac{1 + z^{-2}}{1 + \frac{1}{2}z^{-1}} \quad (2.0.6)$$

$$H(z) = z^{-1} \left[ \frac{1}{1 + \frac{1}{2}z^{-1}} + \frac{z^{-2}}{1 + \frac{1}{2}z^{-1}} \right] \quad (2.0.7)$$

By applying inverse z-transform we get,

$$h(n) = \left[ \frac{-1}{2} \right]^n u(n) + \left[ \frac{-1}{2} \right]^{n-2} u(n-2) \quad (2.0.8)$$

## 1 PROBLEM

Compute

$$X(k) \triangleq \sum_{n=0}^{N-1} x(n)e^{-j2\pi kn/N}, \quad k = 0, 1, \dots, N-1 \quad (1.0.1)$$

and  $H(k)$  using  $h(n)$ .

By using equation 1.0.1

$$X(k) = \sum_{n=0}^{N-1} x(n)e^{-j2\pi kn/N}, \quad k = 0, 1, \dots, N-1 \quad (2.0.9)$$

and

$$H(k) = \sum_{n=0}^{N-1} h(n)e^{-j2\pi kn/N}, \quad k = 0, 1, \dots, N-1 \quad (2.0.10)$$

## 2 SOLUTION

Let

$$x(n) = \left\{ \underset{\uparrow}{1}, 2, 3, 4, 2, 1 \right\} \quad (2.0.1)$$

and the given difference equation is

$$y(n) + \frac{1}{2}y(n-1) = x(n) + x(n-2) \quad (2.0.2)$$

By applying Z-transform to the above equation we get,

$$Y(z) + \frac{1}{2}z^{-1}Y(z) = X(z) + z^{-2}X(z) \quad (2.0.3)$$

$$Y(z) = \frac{2(z^2 + 1)}{z(2z + 1)}X(z) \quad (2.0.4)$$

Therefore  $H(z)$  is

$$H(z) = \frac{2(z^2 + 1)}{z(2z + 1)} \quad (2.0.5)$$

from above mentioned python codes we get the following plots

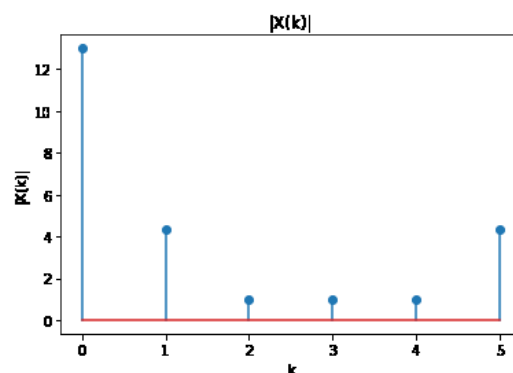


Fig. 0: Magnitude of  $X(k)$

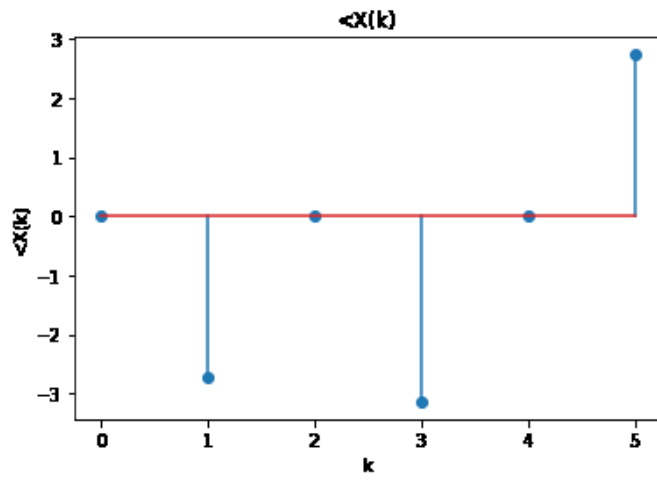


Fig. 0: Phase of  $X(k)$

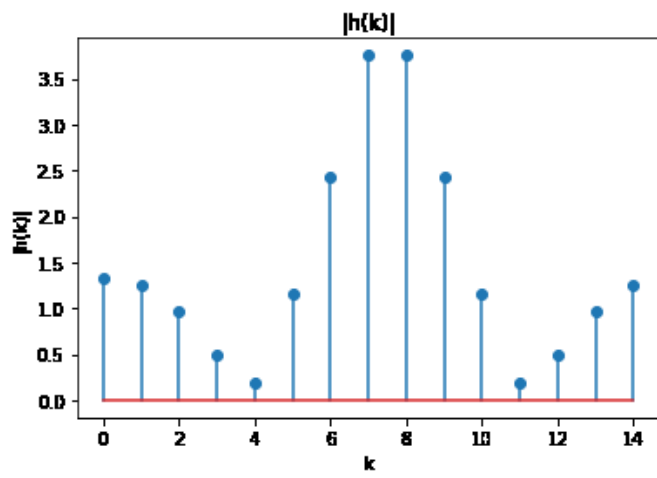


Fig. 0: Magnitude of  $h(k)$

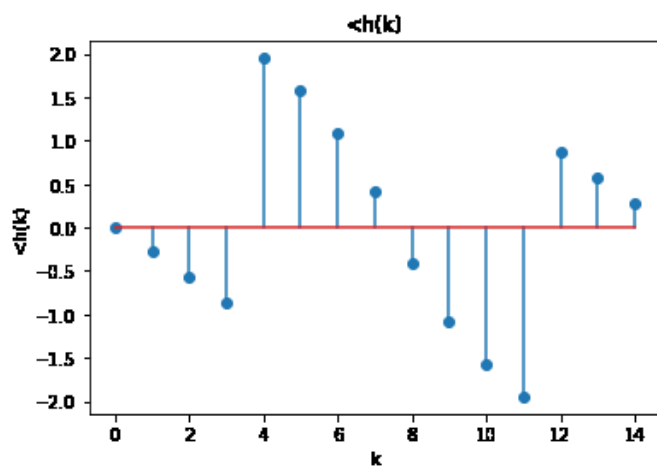


Fig. 0: Phase of  $h(k)$