# EE3025 Presentation

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# Given Problem

Compute

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

and H(k) using h(n)

# Solution

Sol: Given,

$y(n) + (1/2)y(n\text{-}1) = x(n) + x(n\text{-}2) \qquad ...(1)$

Where, $x(n) = \{1,2,3,4,2,1\}$

Now, For H(k) we need h(n)

Taking Z-Transform,

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

and

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

$$H(z) = [\frac{1}{1+(1/2)z^-1} + \frac{z^-2}{1+(1/2)z^-1}]z^-1$$

Taking Inverse-Z transform

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

Now, We know that

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

Where, k= 0,1,....,N-1

*and*

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

Where, k= 0,1,....,N-1

Plots:

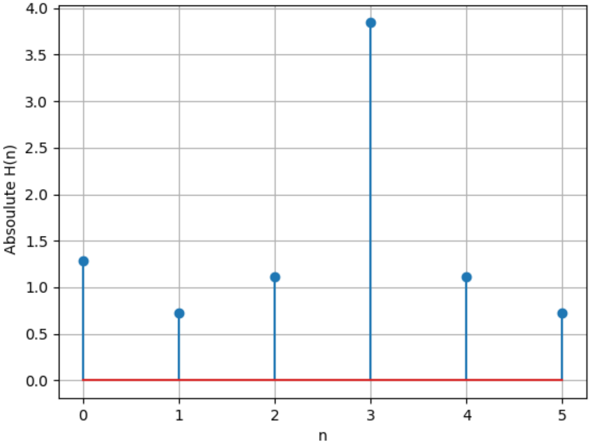


Figure: Absoulute H(K)

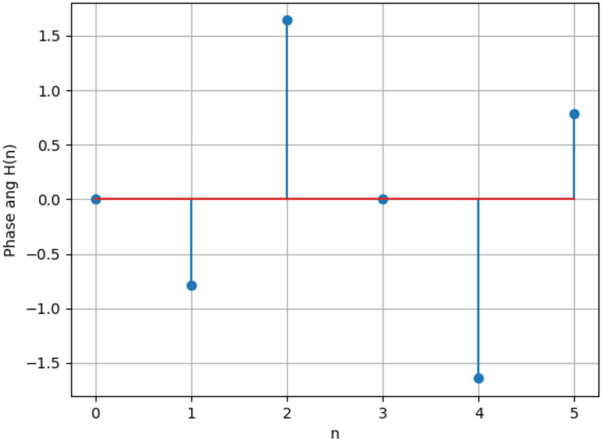


Figure: Angle H(K)

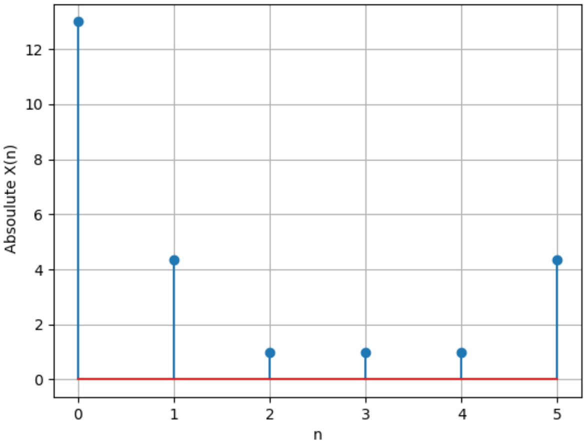


Figure: Absoulute X(K)

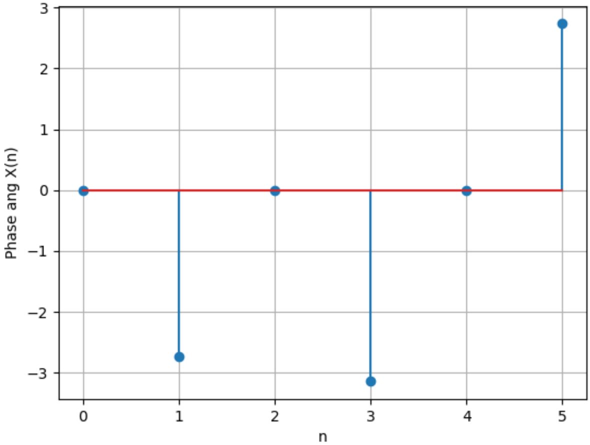


Figure: Angle X(K)

Now, Let's take $e^{-j2\pi kn/N} = W^{nk}$

Expressing (1) in the form of DDT Matrix, N=6

$$\begin{bmatrix} X(0) \\ X(1) \\ X(2) \\ X(3) \\ X(4) \\ X(5) \end{bmatrix} = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & W & . & . & . & W^5 \\ 1 & W^2 & . & . & . & W^{10} \\ 1 & W^3 & . & . & . & W^{15} \\ 1 & W^4 & . & . & . & W^{20} \\ 1 & W^5 & . & . & . & W^{25} \end{bmatrix} \begin{bmatrix} x(0) \\ x(1) \\ x(2) \\ x(3) \\ x(4) \\ x(5) \end{bmatrix}$$

We know that x(n)= { 1,2,3,4,2,1 }

putting the value of x(n) and after solving We get

$X(0) = 13 + 0j$
$X(1) = -4 -1.73j$
$X(2) = 1 + 0j$
$X(0) = -1 + 0j$
$X(0) = 1 + 0j$
$X(0) = -4 + 1.73j$

Which matches with The plots of X(n)

Similarly for H(k), Let's Take N=6 too

$$\begin{bmatrix} H(0) \\ H(1) \\ H(2) \\ H(3) \\ H(4) \\ H(5) \end{bmatrix} = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & W & . & . & . & W^5 \\ 1 & W^2 & . & . & . & W^{10} \\ 1 & W^3 & . & . & . & W^{15} \\ 1 & W^4 & . & . & . & W^{20} \\ 1 & W^5 & . & . & . & W^{25} \end{bmatrix} \begin{bmatrix} h(0) \\ h(1) \\ h(2) \\ h(3) \\ h(4) \\ h(5) \end{bmatrix}$$

We know that

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

putting the value of h(n) and after solving We get,

$H(0) = 1.29 + 0j$
$H(1) = 0.54 - 0.51j$
$H(2) = -1.1 + 1.53j$
$H(3) = -3.8 + 0j$
$H(4) = -1.1 - 1.53j$
$H(5) = 0.54 + 0.51j$

Which matches with The plots of H(n)