NATIONAL INSTITUTE OF TECHNOLOGY SILCHAR

Cachar, Assam

B.Tech. IVth Sem

Subject Code: CS215

Subject Name: Signals and Data Communication

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Branch : CSE – B

1. **A system with frequency response,**

$$H\left(e^{j\omega}\right) = \frac{e^{j\omega}}{e^{j\omega} - 0.7}$$

The system is excited by $x[n] = tri\left(\frac{n-8}{8}\right)$. Use DTFT to find the system response y[n] through MATLAB. Plot excitation, Impulse response and System response. Use 123 sample points. The "tri" function is defined as,

$$tri\,(n) = \begin{cases} 1 - |n| & , |n| < 1 \\ 0 & , otherwise \end{cases}$$

➔ **AIM: TO PLOT EXCITATION, IMPULSE RESPONSE AND SYSTEM RESPONSE FOR A PROVIDED SYSTEM USING 123 SAMPLE POINTS.**

THEORITICAL BACKGROUND:

1. **Impulse Response:** The impulse response of a dynamic system is its output when presented with a brief input signal, called an impulse.
2. **Frequency Response:** The frequency response is the relationship between the system input and the output in the Fourier Domain.
3. **Discrete Time Fourier Signal:** It converts the discrete time signal x[n] into a function $X(e^{j\omega})$ of the discrete frequency ω(rad).

METHODOLOGY:

1. The DTFT is calculated using diric() function.
2. The system response is obtained using ifft() function.
3. The tri signal is obtained using tripuls() function.

CODE:

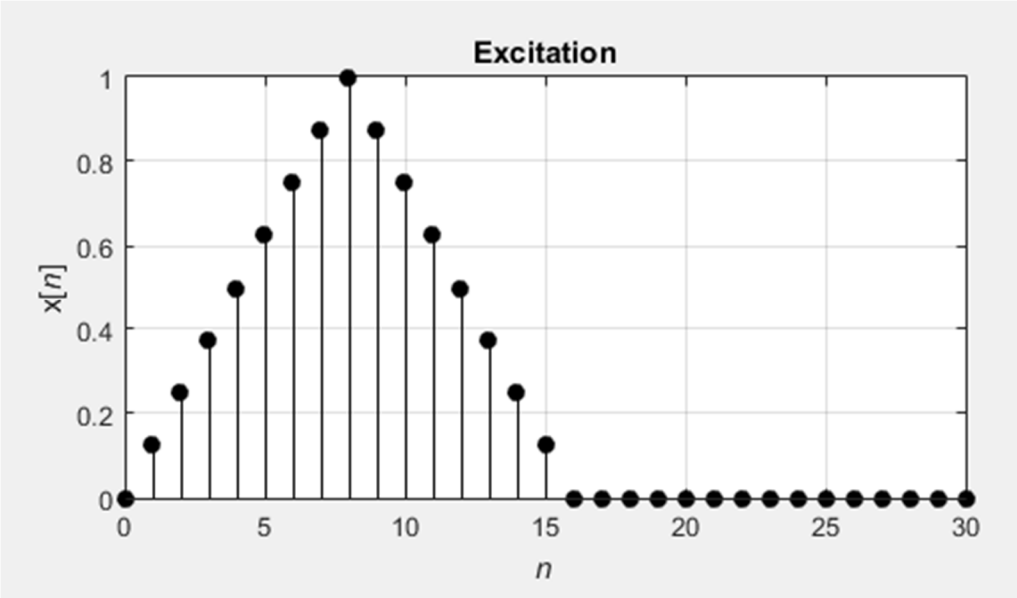
```
clear all;
clc;

N = 128;
k = 0:N-1;
n = k;

x = triangularPulse ((n-8)/8);
X = fft (x);

H = exp (1i*2*pi*k/N) ./ (exp(1i*2*pi*k/N)-0.7);
h = real (ifft(H));

Y = H .* X;
y = real (ifft(Y));

subplot (3, 1, 1);
excitPlt = stem (n, x, 'k', 'filled');
grid on;
pbaspect ([2 1 1]);
axis ([0, 30, 0, 1]);
xlabel ('\itn');
```

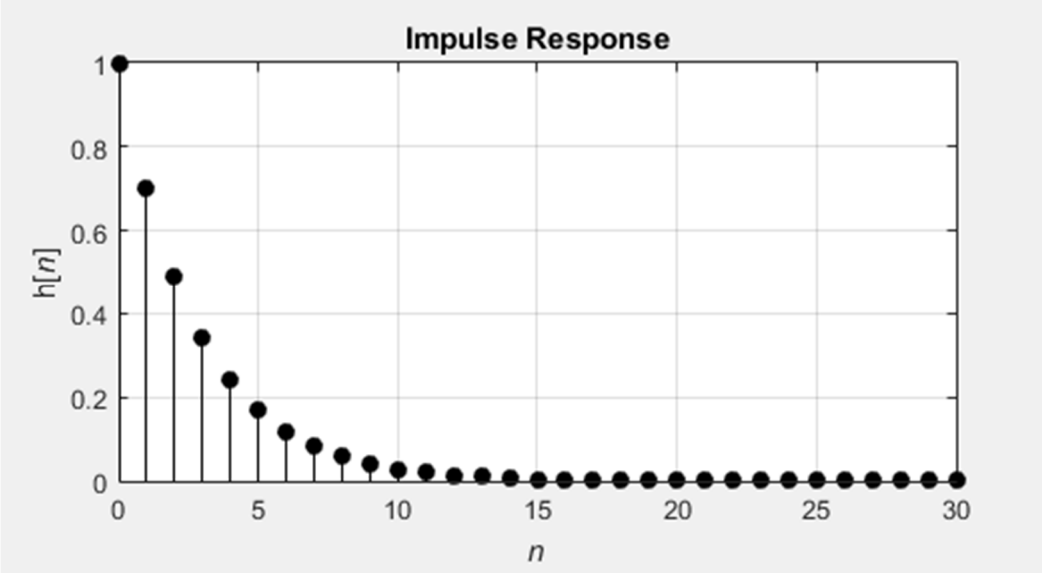
```
ylabel ('x[{\itn}]');
title ('Excitation');

subplot (3, 1, 2);
impulsePlt = stem (n, h, 'k', 'filled');
grid on;
pbaspect ([2 1 1]);
axis ([0, 30, 0, 1]);
xlabel ('\itn');
ylabel ('h[{\itn}]');
title ('Impulse Response');

subplot (3, 1, 3);
respPle = stem (n, y, 'k', 'filled');
grid on;
pbaspect ([2 1 1]);
axis ([0, 30, 0, 3]);
xlabel ('\itn');
ylabel ('y[{\itn}]');
title ('System Response');
```

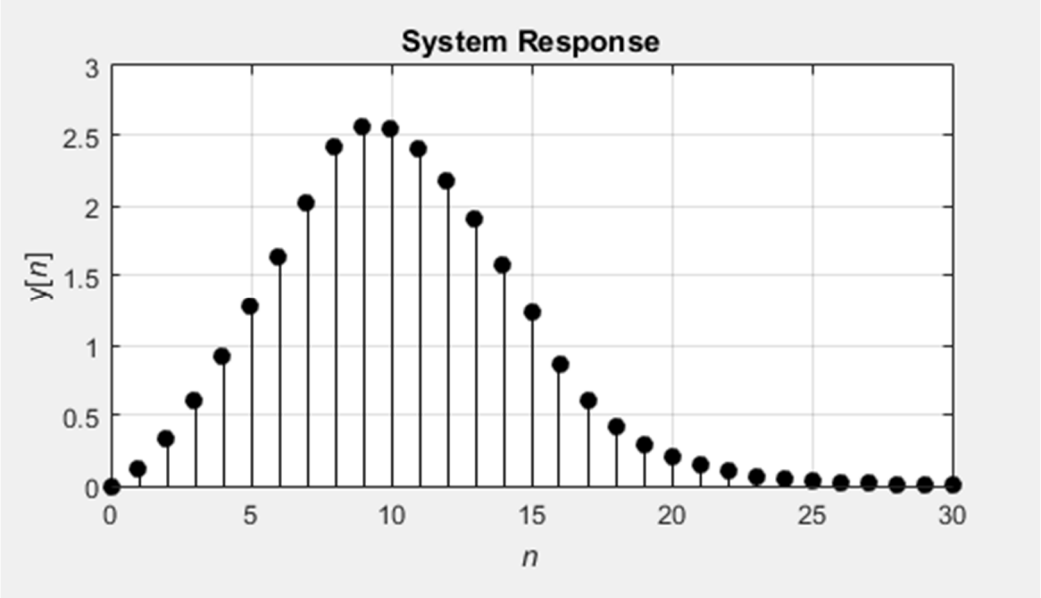
INPUT DATA DESCRIPTION:

The number of samples taken is N = 128.
Only the first 30 samples have been plotted.

RESULT:







CONCLUSION/DISCUSSION:

In the frequency domain, the system response (convolution) is

$$Y(e^{j\omega}) = H\left(e^{j\omega}\right) \cdot X(e^{j\omega})$$

The time domain counterpart can be found by applying the discrete-time inverse Fourier transform.

Hence, the convolution is performed in the frequency domain by multiplying the discrete-time Fourier transforms of the excitation and the impulse response.