

### DFT linearity property

```
Clc;
close all;
clear all;
N=4
x1 = [2 3 4 5]
x2 = [1 3 5 7]
a =2
b = 3
n1=length(x1);
n2=length(x2);
x1=[x1 zeros(1,N-n1)];
x2=[x2 zeros(1,N-n2)];
x3 = a*x1+b*x2
R3= fft (x3,N)
R1= fft (x1,N);
R2= fft (x2,N)
R4=a*R1+b*R2
if R3==R4
disp('Linearity property Verified.')
else
disp('Linearity property not Verified.')
end
```

### DFT Time shift property

```
Clc;
close all;
clear all;
x=[2 5 7 9]
N=4
m=2
y=circshift(x,[0 m])
D=fft(y,N)
X=fft(x,N)
k=0:N-1;
w=exp(-i*2*pi*k*m/N);
X1=w.*X
```

### DFT Frequency shift property

```
x=[3 4 5 6]
m=2
N=4
X=fft(x,N)
X1=circshift(X,[0 m])
disp('shifted DFT sequence.');
```

```
disp(X1);
n=1:N;
w=exp((2*i*pi*(n-1)*(m))/N)
r1=w.*X
X2=fft(r1,N)
```

### DFT convolution property

```
clc;
close all;
clear all;
X=[1 1 1 1]
h=[2 3 4 5]
N=8
N1=4
N2=4
N=max(N1,N2);
x=[x zeros(1,N-N1)];
h=[h zeros(1,N-N2)];
N=max (N1,N2);
y=cconv(x,h,N);
disp(y)% Circular convolution
n = 0:1:N-1
X = fft(x);
H= fft(h);
Y= fft(y)
YI =X.*H
```

### DFT multiplication property

```
[x1(n)*x2(n)=(1/N)*circonv(X1(k)*X2(k))]
```

```
clc;
close all;
clear all;
x1=[1 4 6 8]
x2=[1 3 5 7]
N1=4
N2=4
N=max(N1,N2);
x3=(x1).*(x2);
X1=fft(x1,N);
N1=4;
X2=fft(x2,N);
N2=4;
D=fft(x3,N)
C=cconv(X1,X2,N);
C=C/N
if D==C
disp('multiplication property Verified.')
else
disp('multiplication property Verified.')
end
```

## DFT Parseval's Theorem

clear all;

x1=[1 3 5 7]

x2=[2 4 6 8]

N=4

E=100;

x3=x1.\*x2;

E=sum (x3)

display(E);

X1= fft (x1,N)

X2= fft (x2,N)

X4=conj(X2);

X3=(X1.\*X4);

P = 100;

X3=X3/N;

P= sum (X3)

display(P);

E==P

disp('Parseval property Verified.')

else

disp('Parseval property not Verified.')

end

```

FIR FILTER                                % Blackman Window
Rp=(0.25)                                if Rs<=74 & Rs>53
Rs=(20)                                  N=ceil(12/(Ws-Wp))
Wp=(0.2*3.14)                            y=blackman(N);
Ws=(0.3*3.14)                            figure, subplot(2,1,1), stem(y);title('Blackman Window'); end
%Rectangular Window                      B=firl(N-1,Wp,y)
if Rs<=21                                subplot(2,1,2),stem(B);title('Impulse response of FIR Lowpass Filter');
N=ceil(4/(Ws-Wp))                        figure, freqz(B,1);
y=boxcar(N);                             title('Frequency response of FIR Lowpass Filter')
figure, subplot(2,1,1),stem(y); title('Rectangular Window'); end

% Bartlett Window
If Rs<=25& Rs > 21
N=ceil(8/(Ws-Wp))
y-bartlett(N);
figure, subplot(2,1,1), stem(y);title('Bartlett Window'); end

% Hanning Window
if Rs<=44& Rs>25
N=ceil(8/(Ws-Wp))
y=hanning(N);
figure, subplot(2,1,1),stem(y); title('Hanning Window'); end

% Hamming Window
if Rs<=53 & Rs>44
N=ceil(8/(Ws-Wp))
Y=hamming(N);
figure, subplot(2,1,1),stem(y);title('Hamming Window');end

```

## **BUTTERWORTH**

```
rp=1 ;  
rs=6 ;  
fp=1500  
fs=2000  
Fs=8000  
wp=2*fp/Fs  
ws=2*fs/Fs  
[n,wc]=buttord(wp,ws,rp,rs)  
[p,q]=butter(n,wc);  
freqz(p,q,512,1/Fs)  
title(' IIR BUTTERWORTH LOW PASS FILTER');
```

## **CHEBYSHEV FILTER**

```
clc;  
clear all;  
rp=0.2  
rs=45  
wp=1300  
ws =1500  
fs =10000  
w1=2*wp/fs  
w2=2*ws/fs  
[n,wn] = cheblord(w1,w2,rp,rs)  
[b,a]=cheby 1(n,rp,wn)  
freqz(b,a,512,1/fs);  
grid on;
```



