SamplingTheoremSingleToneSignal.m

% sampling theorem verification for a single tone signal

close all;clc;clear;

t=-1:0.001:1;

% fm must be less than 64

% case\_1 : fs>2fm (hence consider fm1<32)

fm1=input('enter the frequency of continous time signal=');

x=cos(2\*pi\*fm1\*t); % continuous time signal

subplot(311);

plot(t,x);

title('continous time signal');

fs=64;n=0:63;

xn1=cos(2\*pi\*n\*fm1/fs);

xm1=abs(fft(xn1,length(n)));

subplot(312)

stem(n,xn1); % To observe the samples of discrete signal

hold on;

plot(n,xn1);

title('sampling frequency greater than nquist rate')

subplot(313);

stem(n,xm1)

title('dft of signal sampled at greater than nyquiest rate');

% Case\_2 : fs=2fm (hence consider fm2=32)

fm2=input('enter the frequency of continous time signal=');

x=cos(2\*pi\*fm2\*t); % continuous time signal

figure;

subplot(311);

plot(t,x);

title('continuous time signal');

xn2=cos(2\*pi\*n\*fm2/fs);

xm2=abs(fft(xn2,length(n)));

subplot(312)

stem(n,xn2); % To observe the samples of discrete signal

title('dft of signal sampled at nquist rate')

subplot(313);

stem(n,xm2)

title('dft of signal sampled at nquist rate');

% Case\_3 : fs<2fm (hence consider fm3>32)

fm3=input('enter the frequency of continous time signal=');

x=cos(2\*pi\*fm3\*t); % continuous time signal

figure;

subplot(311);

plot(t,x);

title('continous time signal')

xn3=cos(2\*pi\*n\*fm3/fs);

xm3=abs(fft(xn3,length(n)));

subplot(312)

stem(n,xn3); % to observe the samples of discrete signal

title('sampling frequency less than nyquist rate')

subplot(313);

stem(n,xm3)

title('dft of the signal sampled at less than nyquist rate');

enter the frequency of continous time signal=20

enter the frequency of continous time signal=32

enter the frequency of continous time signal=40

>>

Figure 1



Figure 2



Figure 3



SamplingTheoremMultiToneSignal.m

% sampling theorem verification for multitone signal

close all;clc;clear all;

t=-1:0.001:1;

% fm must be less than 64

% Case\_1 : fs>2fm (hence consider fm1 and fm2 <32 )

fm1=input('enter the frequency of first continuous time signal=');

fm2=input('enter the frequency of second continuous time signal=');

x=cos(2\*pi\*fm1\*t)+cos(2\*pi\*fm2\*t); % continuous time signal

subplot(311);

plot(t,x);

title('continuous time signal')

fs=64;n=0:63;

xn1=cos(2\*pi\*n\*fm1/fs)+cos(2\*pi\*n\*fm2/fs);

xm1=abs(fft(xn1,length(n)));

subplot(312)

stem(n,xn1); % to observe the samples of discrete signal

hold on;

plot(n,xn1);

title('sampling frequency greater than nyquist rate');

subplot(313);

stem(n,xm1);

title('dft of signal sampled at greater than nyquist rate');

% Case\_2 : fs=2fm (hence consider fm1<32 and fm2=32)

fm1=input('enter the frequency of first continuous time signal=');

fm2=input('enter the frequency of second continuous time signal=');

x=cos(2\*pi\*fm1\*t)+cos(2\*pi\*fm2\*t); % continuous time signal

figure;

subplot(311);

plot(t,x);

title('continuous time signal')

xn2=cos(2\*pi\*n\*fm1/fs)+cos(2\*pi\*n\*fm2/fs);

xm2=abs(fft(xn2,length(n)));

subplot(312)

stem(n,xn2); % to observe the samples of discrete signal

hold on;

plot(n,xn2);

title('sampling frequency equal to nyquist rate')

subplot(313);

stem(n,xm2)

title('dft of signal sampled at nyquist rate')

% Case\_3: fs<2fm ( hence consider both fm1 and fm2 > 32)

fm1=input('enter the frequency of first continuous time signal=');

fm2=input('enter the frequency of second continuous time signal=');

x=cos(2\*pi\*fm1\*t)+cos(2\*pi\*fm2\*t); % continuous time signal

figure;

subplot(311);

plot(t,x);

title('continuous time signal')

xn3=cos(2\*pi\*n\*fm1/fs)+cos(2\*pi\*n\*fm2/fs);

xm3=abs(fft(xn3,length(n)));

subplot(312)

stem(n,xn3); % to observe the samples of discrete signal

hold on;

plot(n,xn3);

title('sampling frequency less then nyquist rate')

subplot(313);

stem(n,xm3)

title('dft of signal sampled at less than nyquist rate');

enter the frequency of first continuous time signal=20

enter the frequency of second continuous time signal=15

enter the frequency of first continuous time signal=20

enter the frequency of second continuous time signal=32

enter the frequency of first continuous time signal=40

enter the frequency of second continuous time signal=45

>>

Figure 1



Figure 2



Figure 3

