

1 Sampling

1)

```
clc
clear
close all
%%
tvec=0:0.01:2;
x=zeros(size(tvec));
x = (tvec-1).^2;
len = length(tvec);
X=fft(x);
X1=abs(X)/len;
X1=X1(1:round(len/2));
X1(2:end-1) = X1(2:end-1)*2;
f1 = [0:round(len/2)-1]/len/(tvec(2)-tvec(1));

mx=max(X1)/sqrt(2);
mx1=find((X1 >= mx),1,'last');

figure();
plot(f1,X1);
xlim([-20 20]);
title('FFT of X(t)');
ylabel('X(w)');
xlabel('f(Hz)');
hold on;
stem(f1(mx1),X1(mx1),'r','filled');
title('Fourier Transform of Signal');
xlabel('W');
ylabel('X(W)');
grid;
mTxt = sprintf(' Wm = %.2f Hz',f1(mx1)-f1(1));
text(f1(mx1),X1(mx1),mTxt);
Nr = 2*(f1(mx1)-f1(1));
fprintf('Nyquist Rate is %.2f Hz.\n',Nr);
set(gca,'Box','on',....
'FontSize',12,....
'FontWeight','bold',....
'LineWidth',1.5,....
'FontName','Helvetica',....
'Color',[0.95,0.95,0.95]);

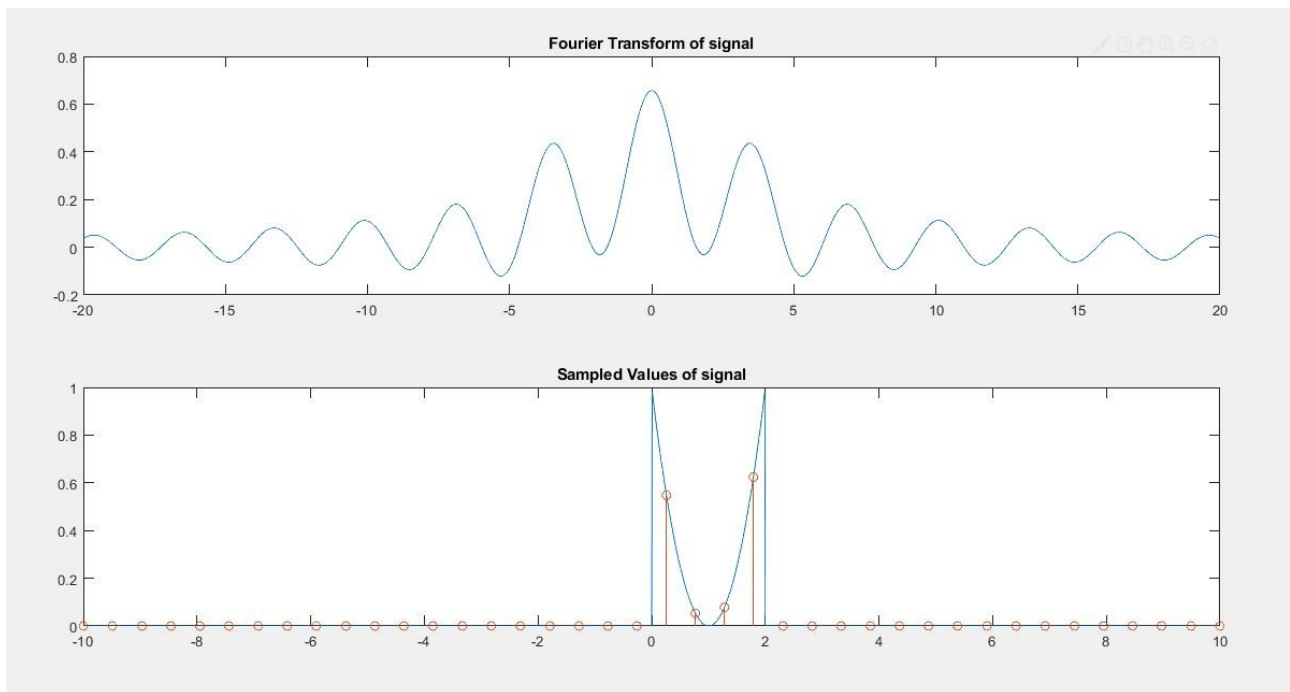
Ns=round(Nr);
sam_inx=1:Ns:len;
xt = zeros(size(x));
xt(sam_inx)= x(sam_inx);
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xt(x==0)=NaN;
figure(2);
title('Sampled Values of Signal');
plot(tvec,x,'b','LineWidth',2);
hold on
plot(tvec,xt,'r','LineWidth',2);

```

Nyquist Rate is 1.00 Hz.



```

2)
clc
clear
close all
%%
tvec=0:0.01:2;
x=zeros(size(tvec));
x = (tvec-1).^2;
len = length(tvec);
X=fft(x);
X1=abs(X)/len;
X1=X1(1:round(len/2));
X1(2:end-1) = X1(2:end-1)*2;
f1 = [0:round(len/2)-1]/len/(sin(tvec)/tvec);

mx=max(X1)/sqrt(2);
mx1=find((X1 >= mx),1,'last');

figure();
plot(f1,X1);
xlim([-20 20]);
title('FFT of X(t)');
ylabel('X(w)');

```

```

xlabel('f(Hz)');
hold on;
stem(f1(mx1),X1(mx1),'r','filled');
title('Fourier Transform of Signal');
xlabel('W');
ylabel('X(W)');
grid;
mTxt = sprintf(' Wm = %.2f Hz',f1(mx1)-f1(1));
text(f1(mx1),X1(mx1),mTxt);
Nr = 2*(f1(mx1)-f1(1));
fprintf('Nyquist Rate is %.2f Hz.\n',Nr);
set(gca,'Box','on',....
'FontSize',12,....
'FontWeight','bold',....
'LineWidth',1.5,....
'FontName','Helvetica',....
'Color',[0.95,0.95,0.95]);

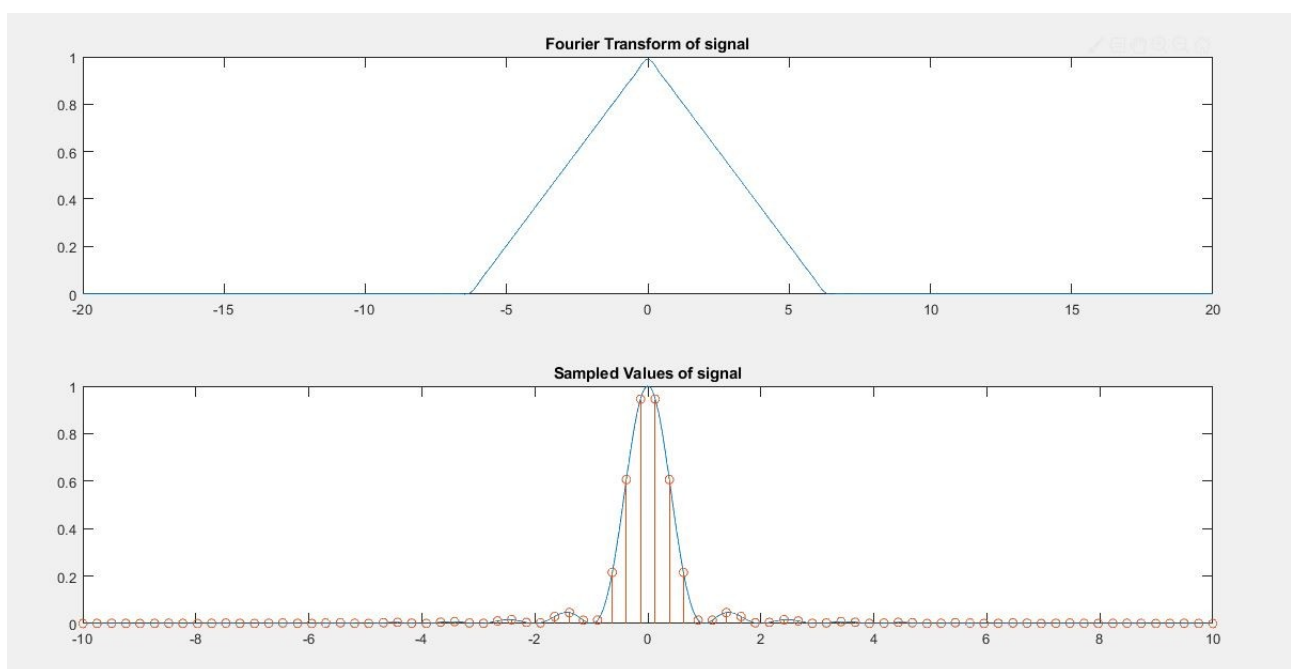
```

```

Ns=round(Nr);
sam_inx=1:Ns:len;
xt = zeros(size(x));
xt(sam_inx)= x(sam_inx);
xt(x==0)=NaN;
figure(2);
title('Sampled Values of Signal');
plot(tvec,x,'b','LineWidth',2);
hold on
plot(tvec,xt,'r','LineWidth',2);

```

Nyquist Rate is 2.00 Hz.



3)
clc

```

clear
close all
%%
tvec=0:0.01:2;
x=zeros(size(tvec));
x = (tvec-1).^2;
len = length(tvec);
X=fft(x);
X1=abs(X)/len;
X1=X1(1:round(len/2));
X1(2:end-1) = X1(2:end-1)*2;
f1 = [0:round(len/2)-1]/len/(cos(pi*tvec));

mx=max(X1);
mx1=find((X1 >= mx),1,'last');

figure();
plot(f1,X1);
xlim([-20 20]);
title('FFT of X(t)');
ylabel('X(w)');
xlabel('f(Hz)');
hold on;
stem(f1(mx1),X1(mx1),'r','filled');
title('Fourier Transform of Signal');
xlabel('W');
ylabel('X(W)');
grid;
mTxt = sprintf(' Wm = %.2f Hz',f1(mx1)-f1(1));
text(f1(mx1),X1(mx1),mTxt);
Nr = 2*(f1(mx1)-f1(1));
fprintf('Nyquist Rate is %.2f Hz.\n',Nr);
set(gca,'Box','on',....
'FontSize',12,....
'FontWeight','bold',....
'LineWidth',1.5,....
'FontName','Helvetica',....
'Color',[0.95,0.95,0.95]);

Ns=round(Nr);
sam_inx=1:Ns:len;
xt = zeros(size(x));
xt(sam_inx)= x(sam_inx);
xt(x==0)=NaN;
figure(2);
title('Sampled Values of Signal');
plot(tvec,x,'b','LineWidth',2);
hold on
plot(tvec,xt,'r','LineWidth',2);

```

Nyquist Rate is 1.00 Hz.

