Pluse Shaper

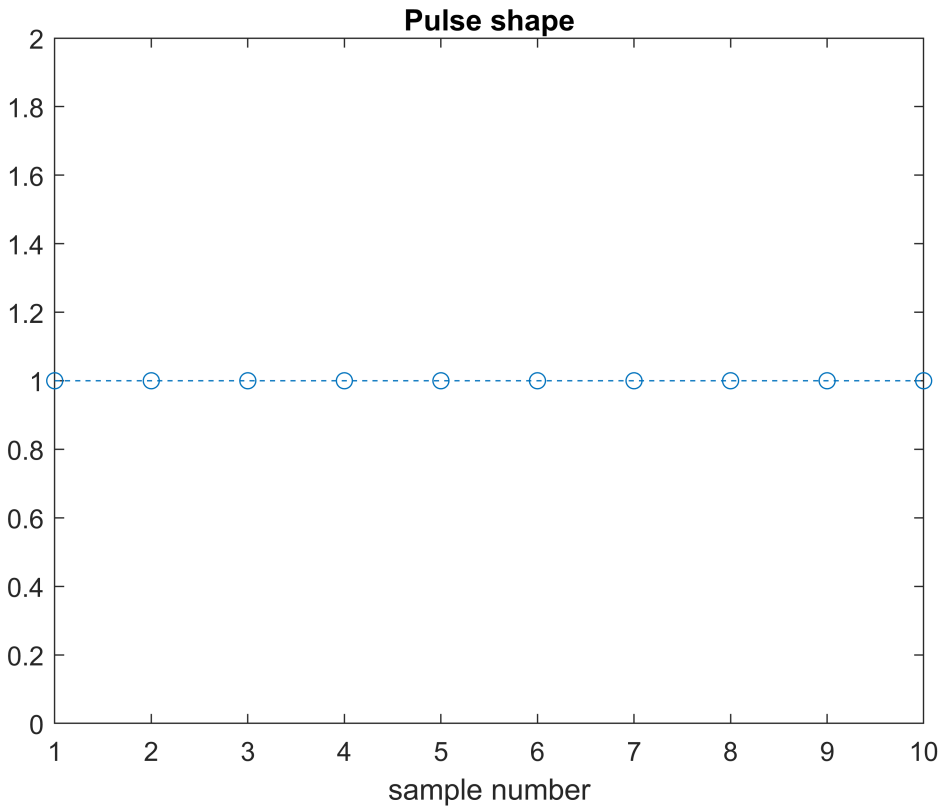
The following code segment defines a set of symbols representing complex numbers and initializes parameters for a pulse amplitude modulation (PAM) system, generating a modulated signal (x) and the corresponding pulse shape. Then plotting pulse shape and signals

```
clear all
symbols=[1+j -1-j -1+j 1-j -1-j 1+j 1+j -1-j 1+j -1+j -1+j 1-j 1+j -1-j 1+j 1-j];
Nf=200; % number of samples of the basic pulse
nsps=10; % number of samples of the PAM signal in a symbol time
rolloff=0.2; % rool-off factor for the root raised cosine pulse
pulsetype="RECT"; % choose the pulse type by uncommenting the corresponding line
```

PAMmodulator rectangular pluse

The following code segment chooses a rectangular pluse as a basic pluse, mapping from bits to symbols by convolution opeartion.

```
[x,h,Delay]=PAMmodulator_2023(symbols,nsps,Nf,pulsetype,rolloff);
plot(h,'--o')
xlabel('sample number')
title('Pulse shape')
```



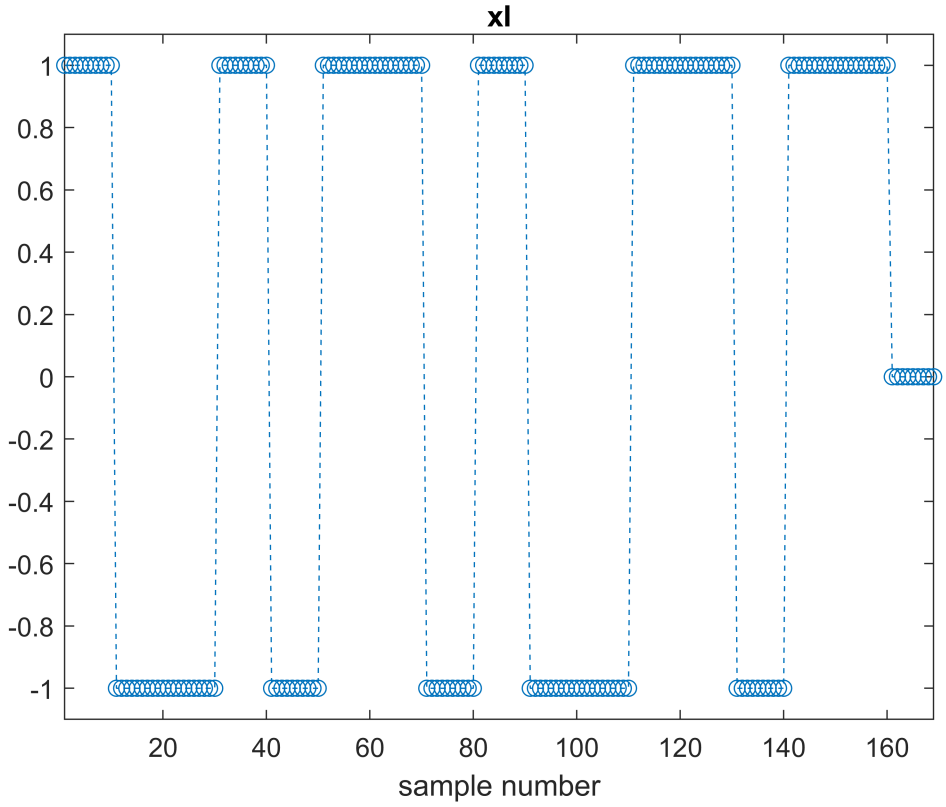
One time continuous waveform is represented by means of nsps=10 samplings with amplitude is 1.

```
figure
plot(real(x),'--o')
xlabel('sample number')
```

```
title('xI')
real(symbols)
```

```
ans = 1×16
     1    -1    -1     1    -1     1     1    -1     1    -1    -1     1     1 ···
```

```
axis([1 length(x) 1.1*min(real(x)) 1.1*max(real(x))])
```

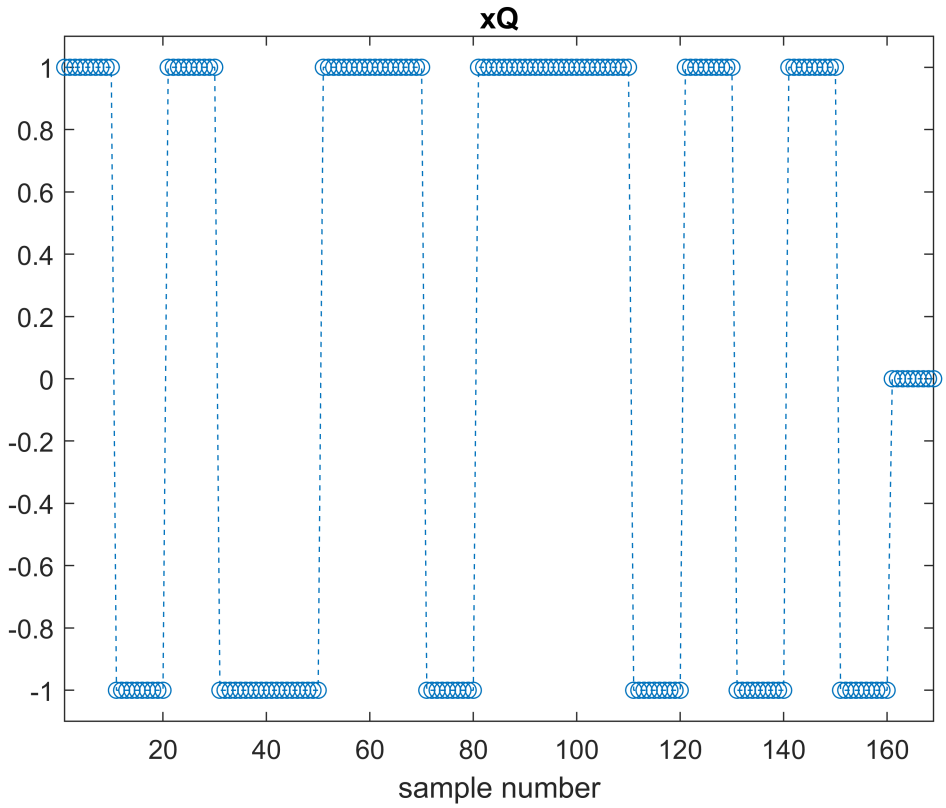


This picture shows the result of PAM signal with rectangular pulses corresopend to in phase components of signals.

```
figure
plot(imag(x),'--o')
xlabel('sample number')
title('xQ')
imag(symbols)
```

```
ans = 1×16
     1    -1     1    -1    -1     1     1    -1     1     1     1    -1     1 ···
```

```
axis([1 length(x) 1.1*min(imag(x)) 1.1*max(imag(x))])
```

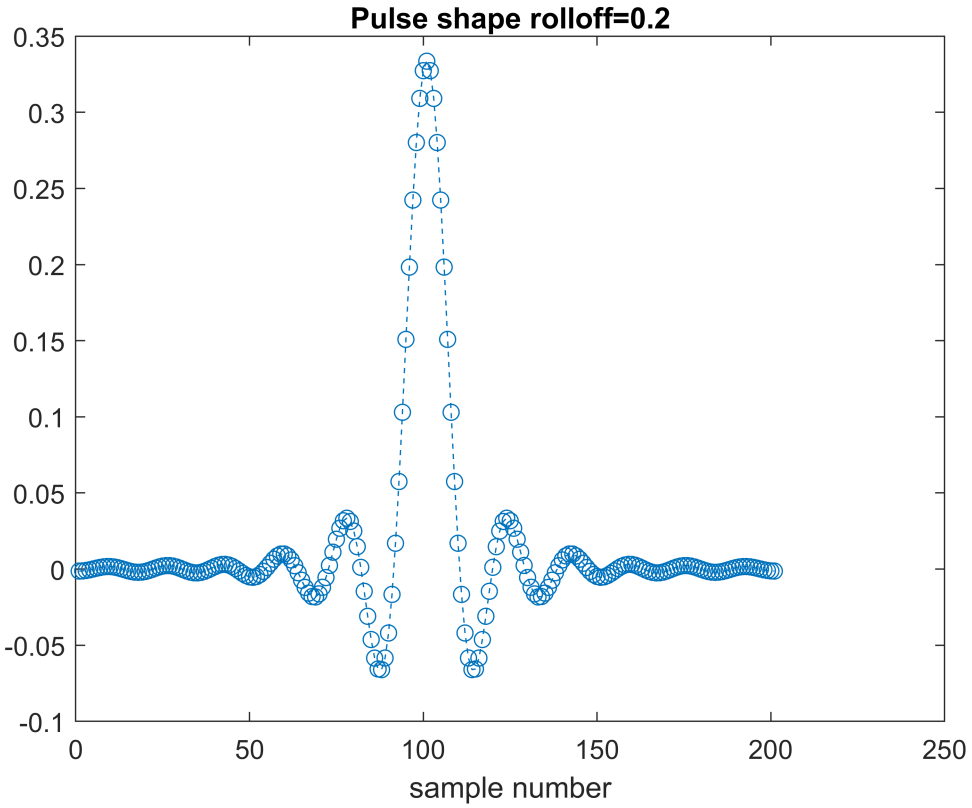


This picture shows the result of PAM signal with rectangular pulses corresopend to in *quadrature* components of signals.

PAMmodulator (rootraisedcosine pluse)

Similar to the previous code, the following code chooses rootraisdconsine pluse shape as basic pluse and compared with different rolloff.

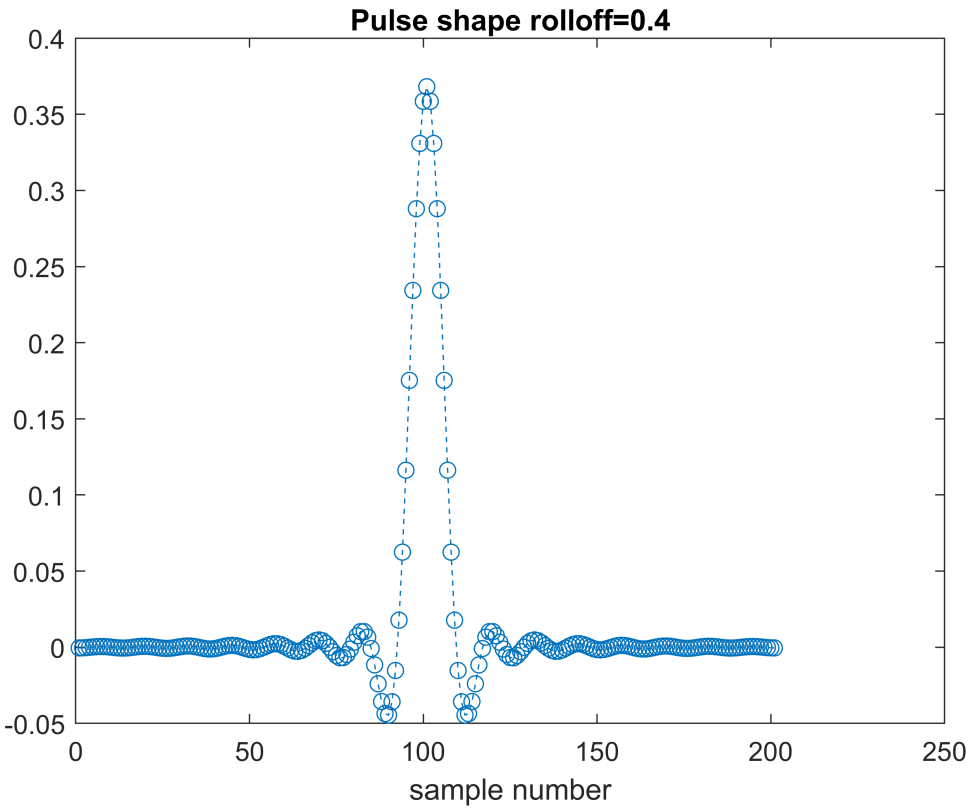
```
pulsetype="ROOTRAISEDCOSINE"; % choose the pulse type by uncommenting the corresponding line
[x,h,Delay]=PAMmodulator_2023(symbols,nsps,Nf,pulsetype,rolloff);
[x1,h1,Delay]=PAMmodulator_2023(symbols,nsps,Nf,pulsetype,rolloff*3);
[x2,h2,Delay]=PAMmodulator_2023(symbols,nsps,Nf,pulsetype,rolloff*5);
plot(h,'--o')
xlabel('sample number')
title('Pulse shape rolloff=0.2')
```



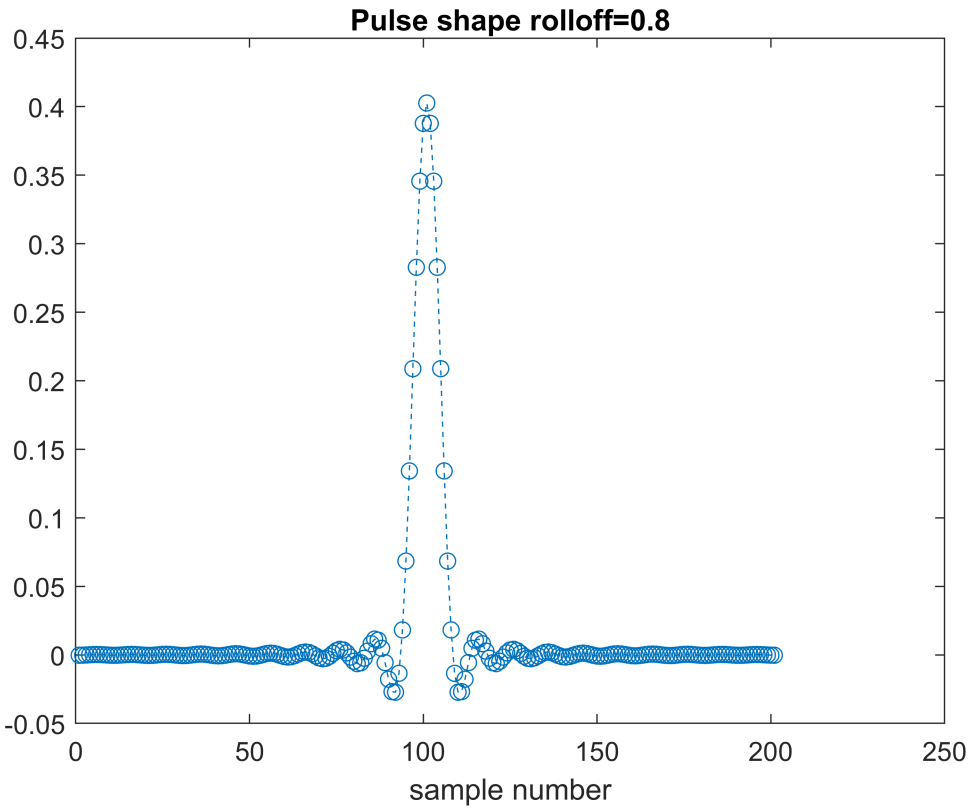

```
real(symbols)
```

```
ans = 1×16
     1    -1    -1     1    -1     1     1    -1     1    -1    -1     1     1 ···
```

```
plot(h1,'--o')
xlabel('sample number')
title('Pulse shape rolloff=0.4')
```




```
plot(h2,'--o')
xlabel('sample number')
title('Pulse shape rolloff=0.8')
```

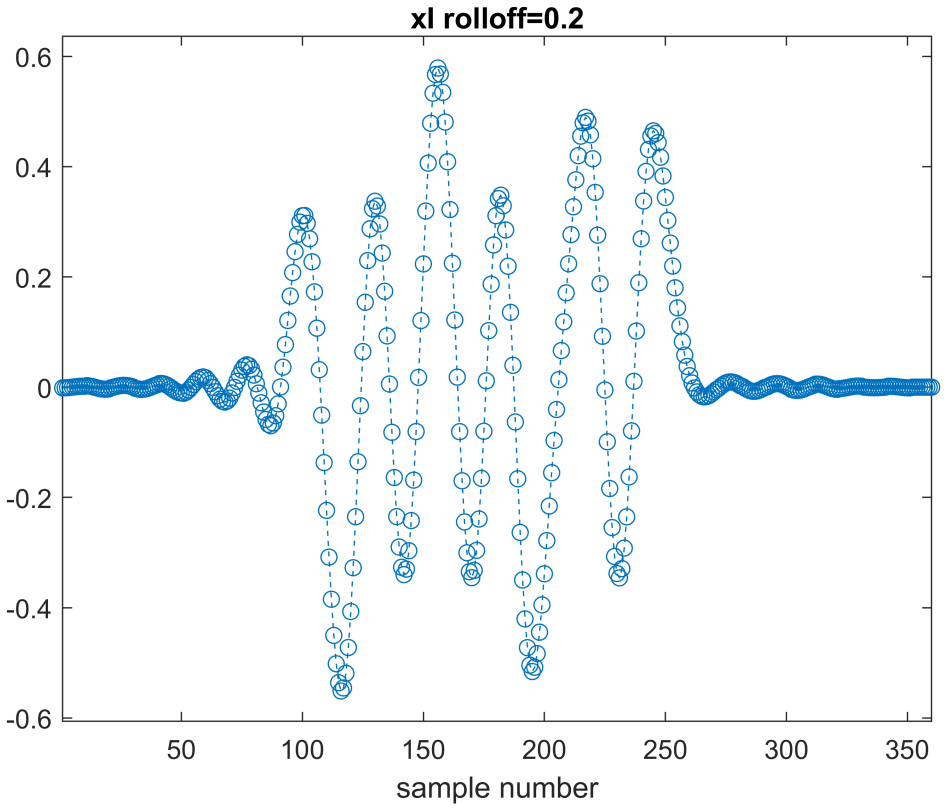


Comparing to three different rolloff It can be concluded the larger rolloff the larger, the greater the amplitude of the signal and the faster the attenuation,

```
figure
plot(real(x),'--o')
xlabel('sample number')
title('xI rolloff=0.2')
real(symbols)
```

```
ans = 1×16
     1    -1    -1     1    -1     1     1    -1     1    -1    -1     1     1 ···
```

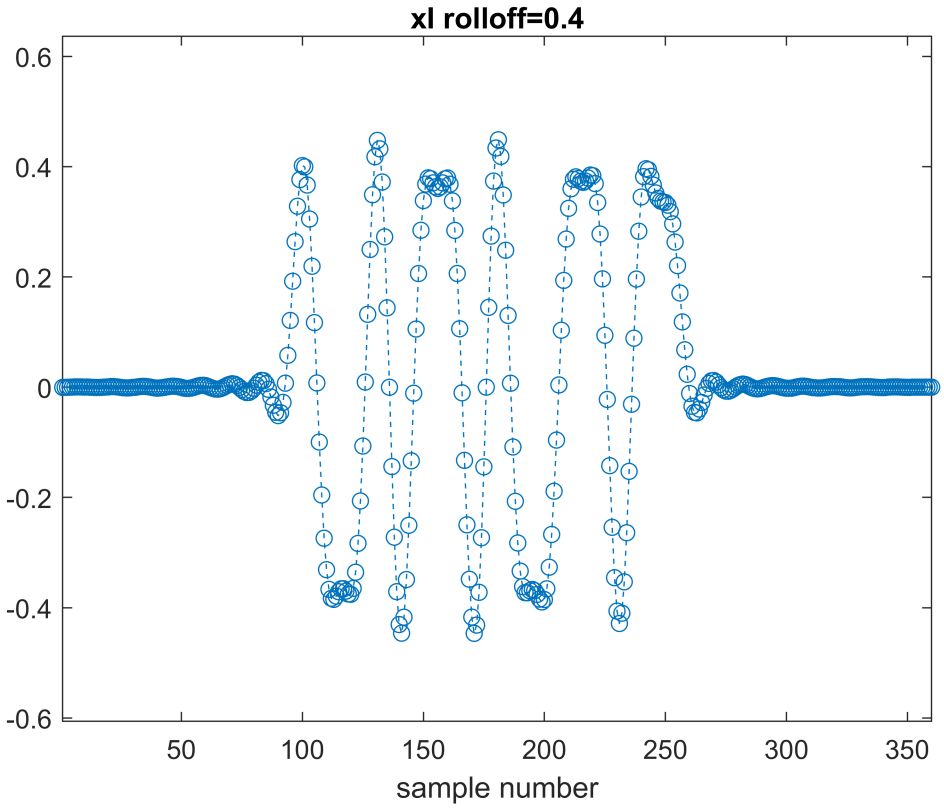
```
axis([1 length(x) 1.1*min(real(x)) 1.1*max(real(x))])
```




```
figure
plot(real(x1),'--o')
xlabel('sample number')
title('xI rolloff=0.4')
real(symbols)
```

```
ans = 1×16
     1    -1    -1     1    -1     1     1    -1     1    -1    -1     1     1 ···
```

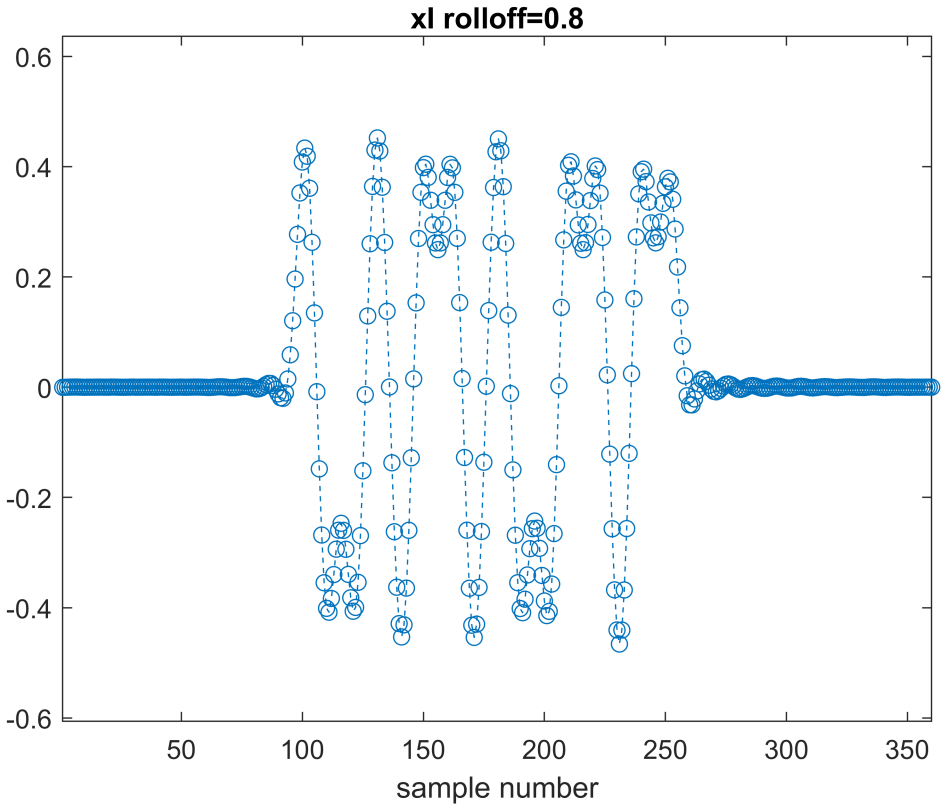
```
axis([1 length(x) 1.1*min(real(x)) 1.1*max(real(x))])
```




```
figure
plot(real(x2),'--o')
xlabel('sample number')
title('xI rolloff=0.8')
real(symbols)
```

```
ans = 1×16
     1    -1    -1     1    -1     1     1    -1     1    -1    -1     1     1 ···
```

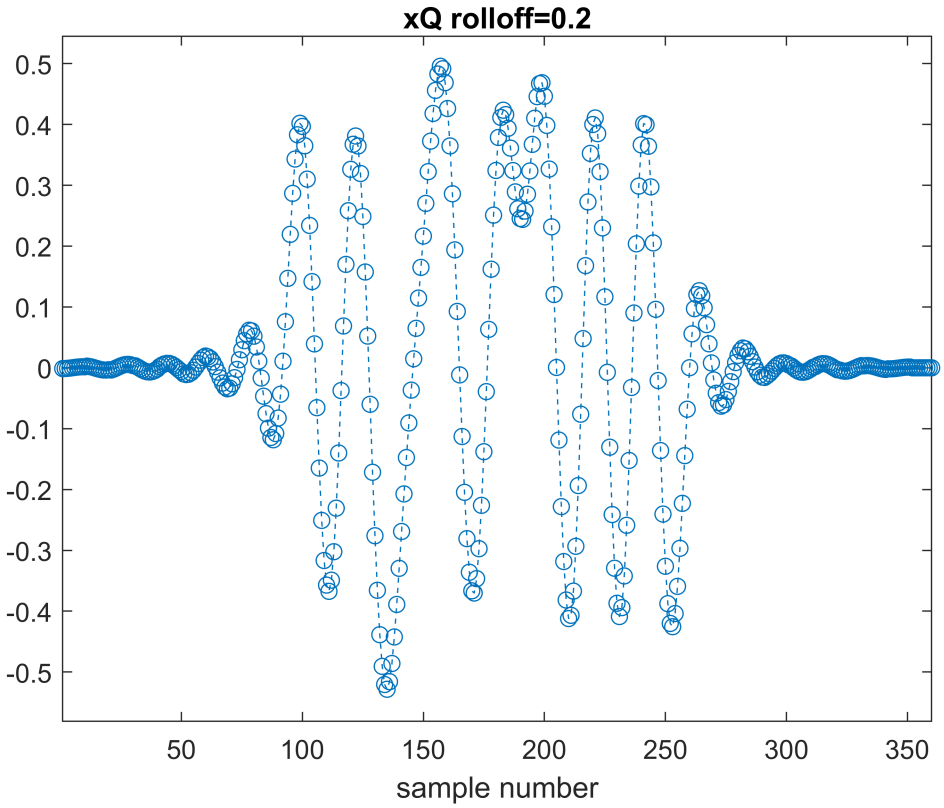
```
axis([1 length(x) 1.1*min(real(x)) 1.1*max(real(x))])
```




```
figure
plot(imag(x),'--o')
xlabel('sample number')
title('xQ rolloff=0.2')
imag(symbols)
```

```
ans = 1×16
     1    -1     1    -1    -1     1     1    -1     1     1     1    -1     1 ···
```

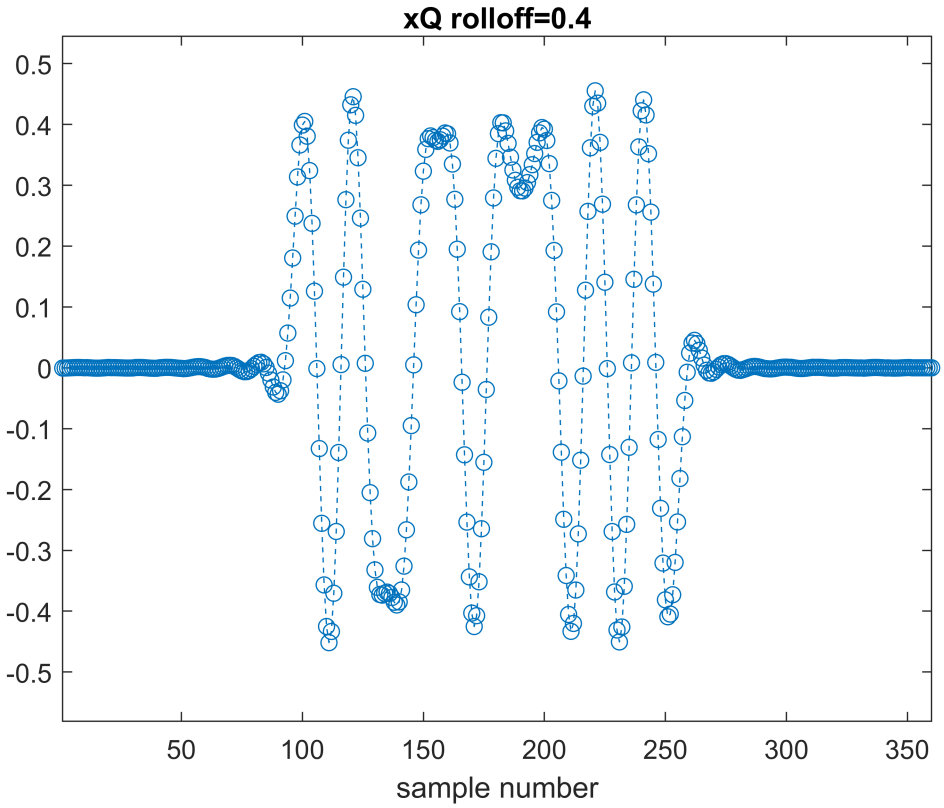
```
axis([1 length(x) 1.1*min(imag(x)) 1.1*max(imag(x))])
```




```
figure
plot(imag(x1),'--o')
xlabel('sample number')
title('xQ rolloff=0.4')
imag(symbols)
```

```
ans = 1×16
     1    -1     1    -1    -1     1     1    -1     1     1     1    -1     1 ···
```

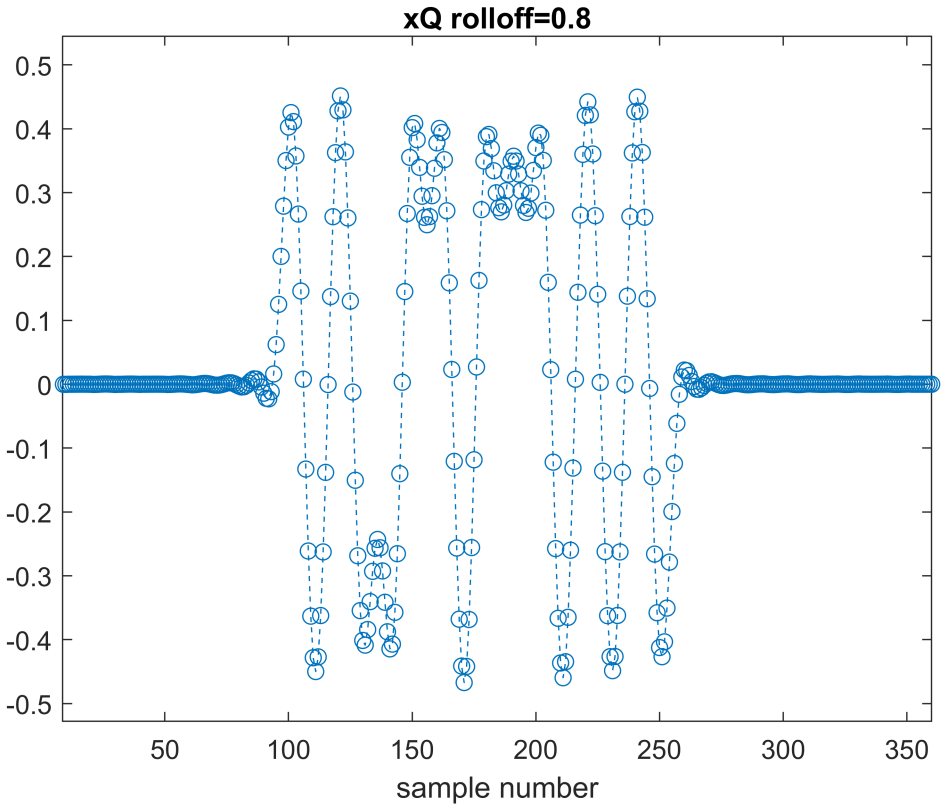
```
axis([1 length(x) 1.1*min(imag(x)) 1.1*max(imag(x))])
```




```
figure
plot(imag(x2),'--o')
xlabel('sample number')
title('xQ rolloff=0.8')
imag(symbols)
```

```
ans = 1×16
     1    -1     1    -1    -1     1     1    -1     1     1     1    -1     1 ···
```

```
axis([1 length(x) 1.1*min(imag(x)) 1.1*max(imag(x))])
```



Comparing to symbols sequence with different rolloff, It can be concluded the larger rolloff, the more the waveform tends to be in a rectangular pluse, and the smaller rolloff, the more waveform tends to be in a sinc pluse.