

# Software and Systems Engineering

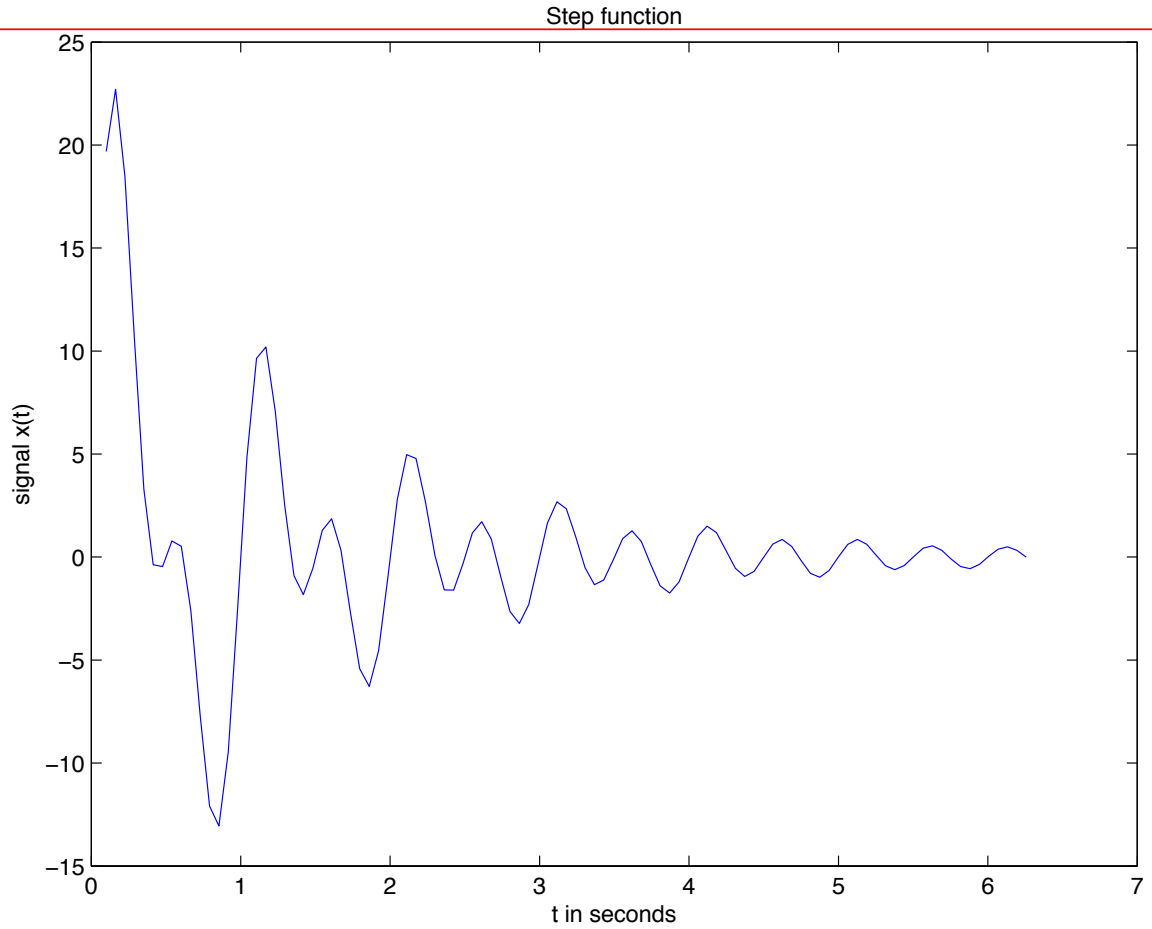
## CPE3202

**Pornpawit Boonsrimuang**

# Step function

```
clear all;
Clc;
Clf;
close;

%%%%%%%%%%%%%%%%%%%%%%%%%

t = 0.1:2*pi/100:2*pi                                          % t ranges from 0.1 to 2*pi
x =10* exp(-0.5*t).*sin(4*pi*t) + 20*exp(-t).*sin(2*pi*t);     %  generates values for xplot(t,x);

%plot the signal

xlabel('t in seconds')
ylabel('signal x(t)')
Title('Step function')


 %%%%%%%%%% End %%%%%%%%%%
```

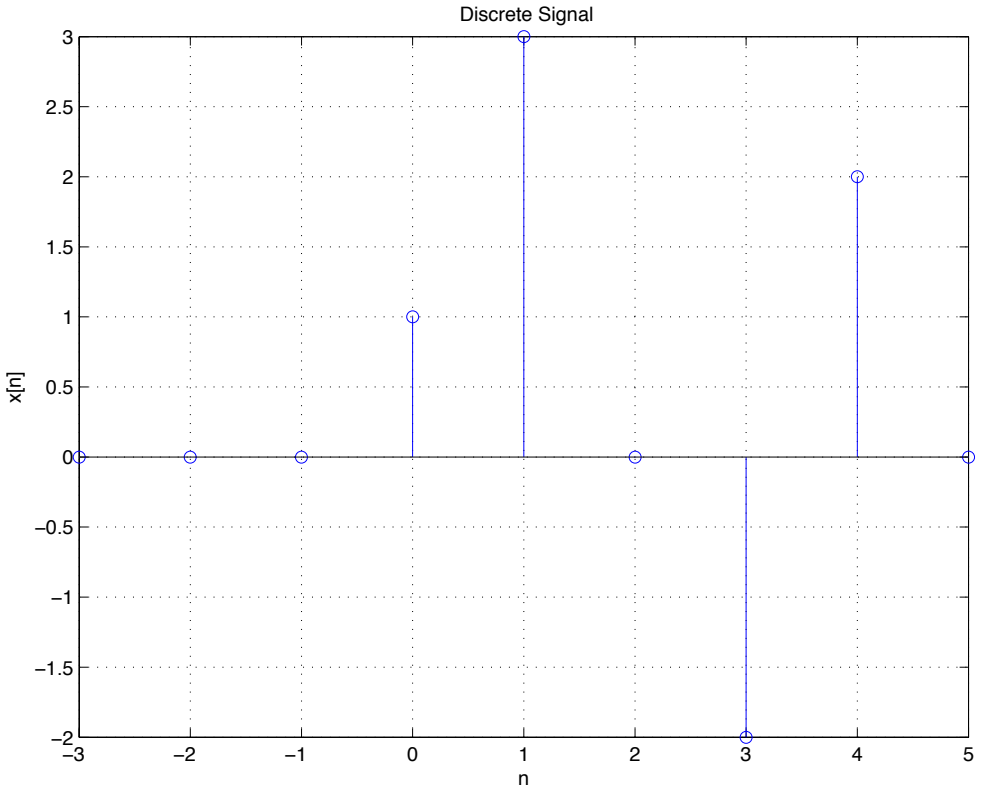
# Step function



# Discrete Signal

```
clear all;
Clc;
Clf;
close;

%%%%%%%%%%%%%%%%%%%%%%%%%%
n=-3:1:5; % n = -3, -4,...,4,5

x=[ 0 0 0 1 3 0 -2 2 0 ];

stem(n,x)

xlabel('n');

ylabel('x[n]');
grid;

%%%%%%%%%% End %%%%%%%%%%
```

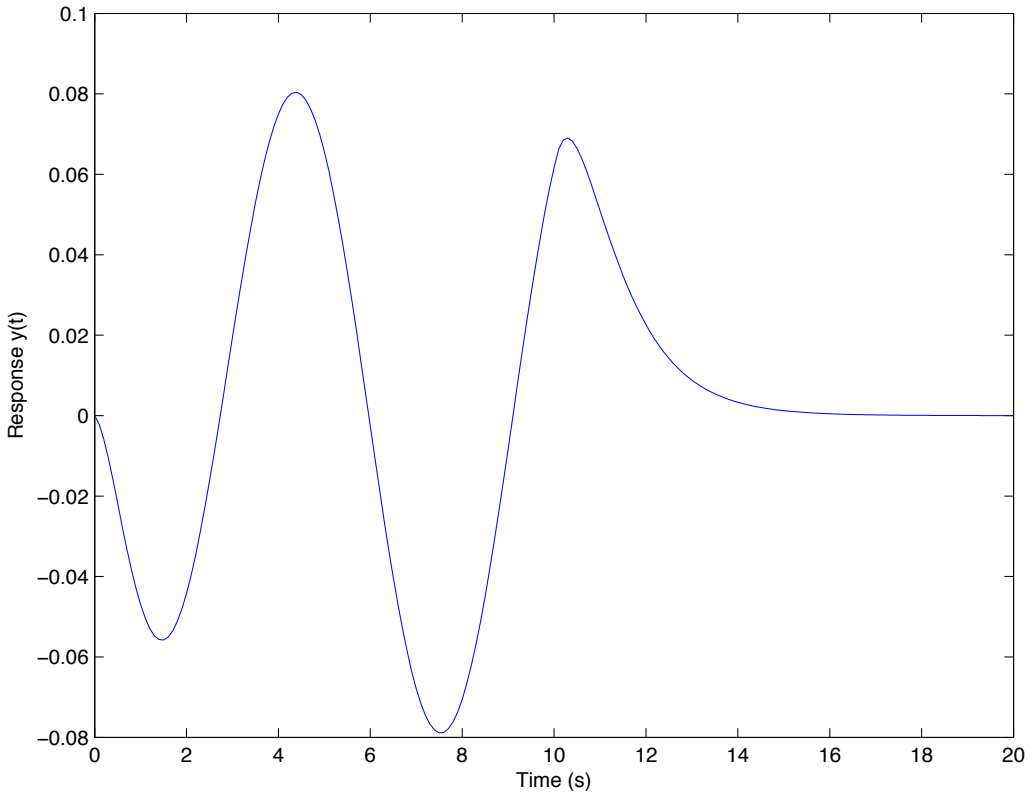
# Discrete Signal



# Impulse response with sampling period

```
clear all;
Clc;
Clf;
close;
%%%%%%%%%%%%%%%%%%%%

T = 0.1;                              % sampling period
t = 0:T:10;
x = cos(t);                           % calculates x(t)
h = 0.25*(exp(−2*t) − exp(−t));       % calculates h(t)
y = T*conv(x,h);                      %this contains Lx + Lh − 1
t0 = (0:200)*T
plot(t0,y) % or use this
plot(t,y(1:101))
xlabel('Time (s)')
ylabel('Response y(t)')

%%%%%%%%%%%%%%%%%%%%
```

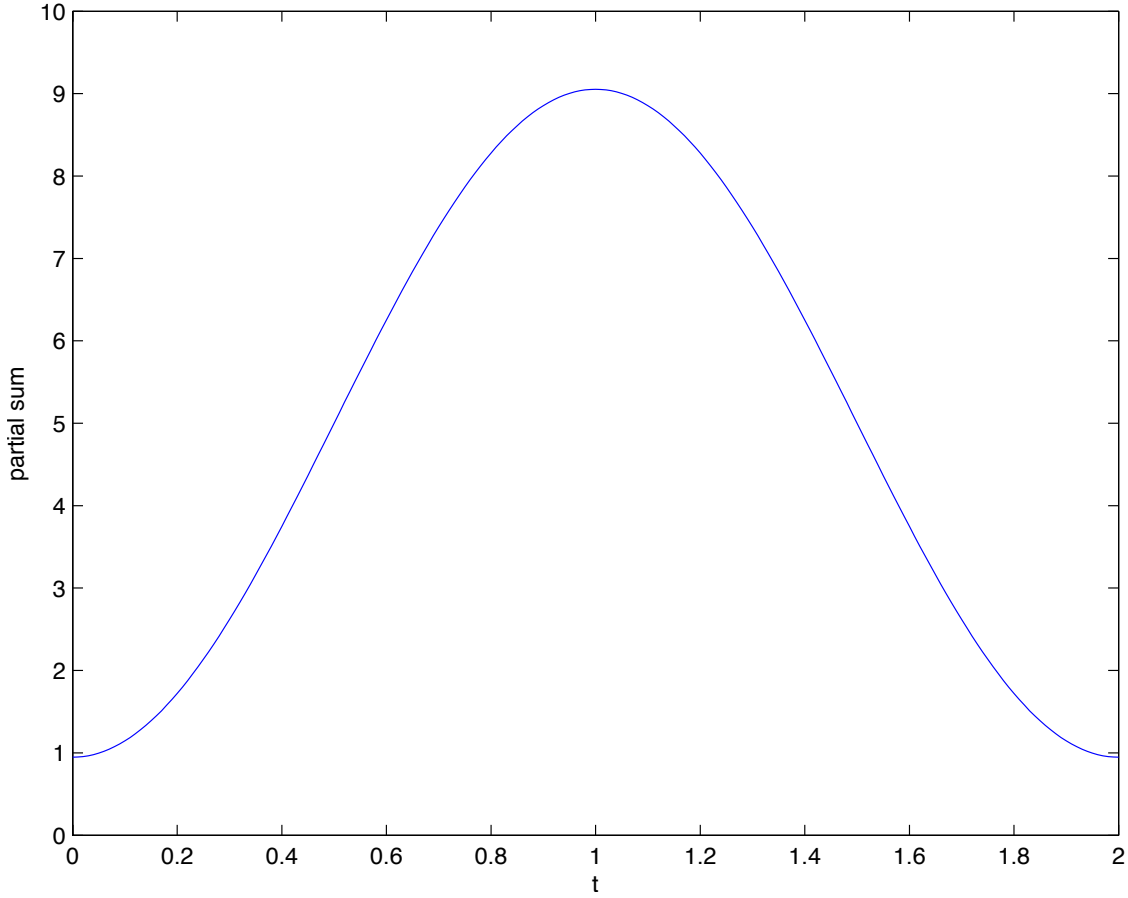
# Impulse response



# Convergence of Fourier series

```
clear all;
Clc;
Clf;
close;

%%%%%%%%%%%%%%%%%%%%

N = input('Enter the highest harmonic desired'); %3, 5, 10
t=0:0.01:2;
xN = 5*ones(1,length(t)); % dc component
fac = -40/(pi*pi);
for n=1:N  xN = xN + fac*cos( (2*n -1)*pi*t )/( (2*n-1)^2);
end
plot(t,xN)
xlabel('t')
ylabel('partial sum')
%%%%%%%%%%%%%%%%%%%%
```

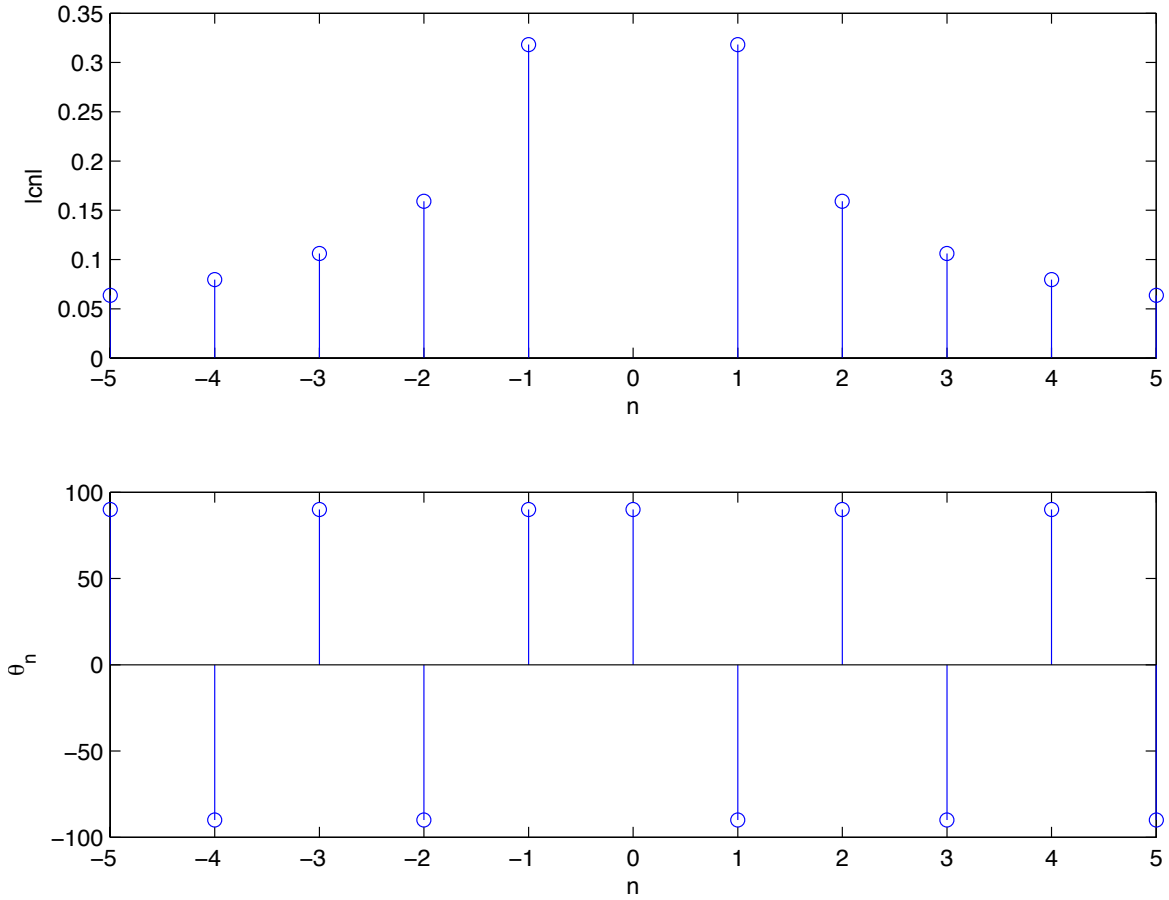
# Result



# Stem plot

```
Clear
Clc
n = -5:1:5;
c1 = j*(-1).^n;
c2 = n*pi;
if n==0
cn = 0; else
cn=c1./c2;
End
mag = abs(cn);
phase = angle(cn)*180/pi; % converts angle in radians to degrees
subplot(2,1,1);
stem(n,mag)
xlabel('n');
ylabel('|cn|')
subplot(2,1,2);
stem(n,phase)
xlabel('n');
ylabel('\theta_n')
```

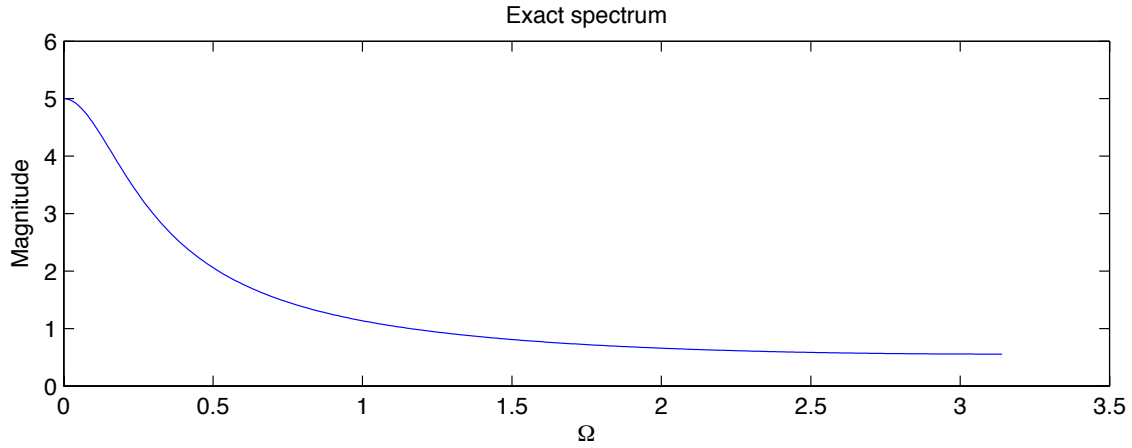
# Stem

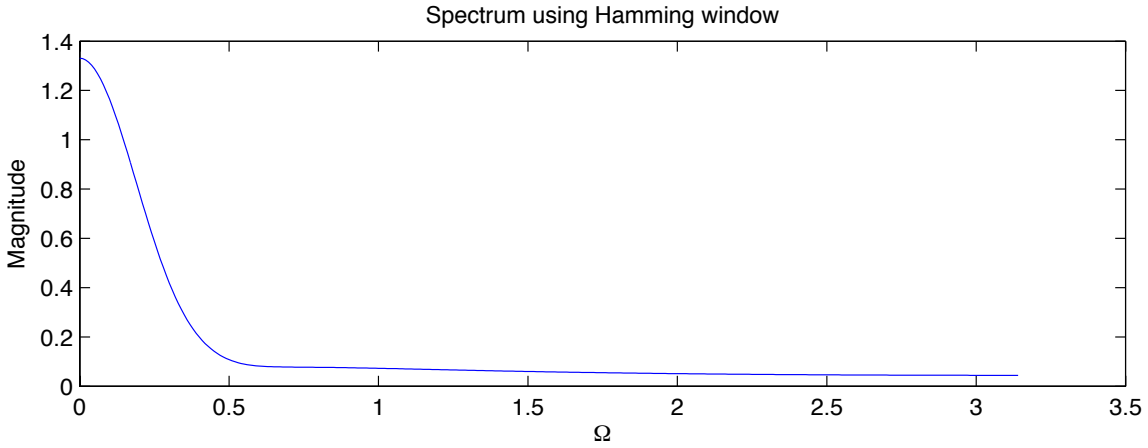

0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
|cn|
−5
−4
−3
−2
−1
0
1
2
3
4
5
n
100
50
0
−50
−100
θn
−5
−4
−3
−2
−1
0
1
2
3
4
5
n

# Spectrum using Hamming window

```
a=0.8;
N = 32;
n = 0:N-1w = 0:0.01:pi; % values of Omega
fe = abs(1./(1 - a*exp(-j*w))); % exact DTFT
subplot(2,1,1)
plot(w,fe)
title('Exact spectrum');
xlabel('\Omega');
 ylabel('Magnitude');
 wh = 0.54 - 0.46*cos(2*pi*n'/(N-1)) %Hamming window
fh=abs((a.^n'.*wh)'*exp(-j*n'*w));
fhs = sum(fh,1); %sums columns of N x length(w) matrix fh
subplot(2,1,2)
plot(w,fhs)
title('Spectrum using Hamming window');
xlabel('\Omega');
ylabel('Magnitude');
```

# Spectrum Hamming window



# Since function

```
Clear all;
Clc;
Close;
%%%%%%%%%%%%%%%%%%%%%%%%%%%%
t = -5*pi:0.25:5*pi;
Sinc_0 = sin(t)./(pi*t);
Sinc_1 = sin(t-pi)./(pi*(t-pi));
Sinc_2  = sin(t-2*pi)./(pi*(t-2*pi));
Sinc_3  = sin(t-3*pi)./(pi*(t-3*pi));
plot(t,Sinc_0,'*:',t,Sinc_1,'d-.',t,Sinc_2,'h--',t,Sinc_3,'s-')
xlabel('time')
ylabel('Amplitude')
title('First four members of the sinc family')
legend('sinc 0','sinc 1','sinc 2','sinc 3')


%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

# Since function