BME 306 Lab 1 - introduction to discrete signals

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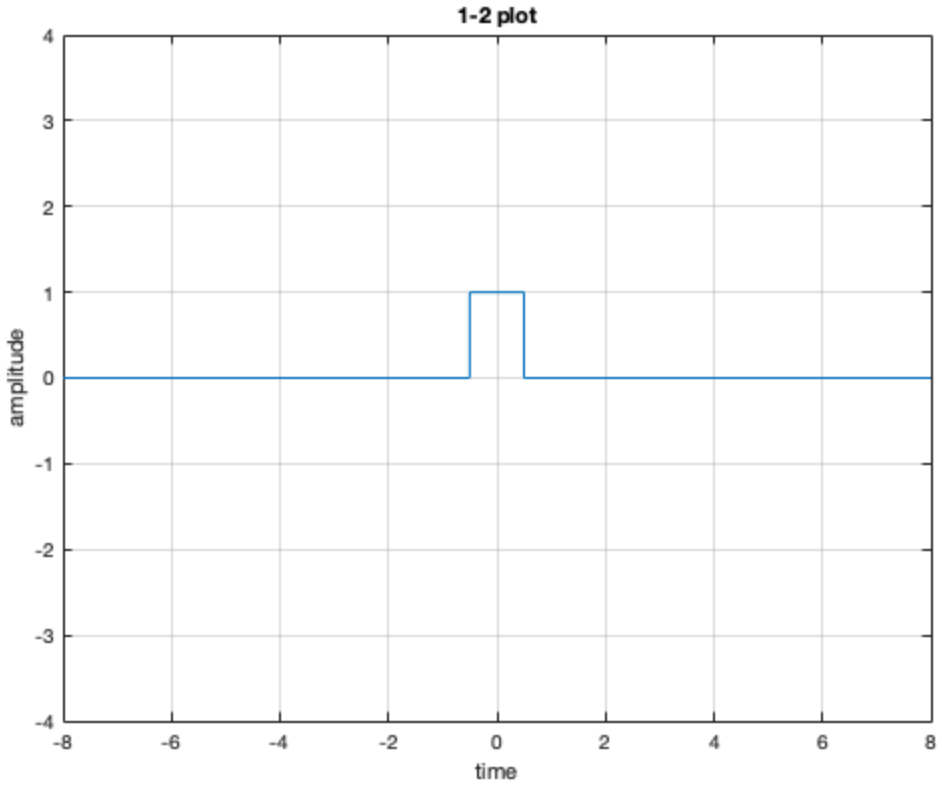
Question 2

Create a unit rectangle using the rectpuls command and plot it.

```
clear all;
close all;
clf;
figure(1); % start a new figure
t=-8:0.001:8; % define a time axis
s = rectpuls(t); % unit rectangle
plot(t,s); % create plot
grid on; % add grid lines
axis([-8 8 -4 4]); % scale the display axes
xlabel('time'); % supply a x-axis label
ylabel('amplitude'); % supply a y-axis label
title('1-2 plot'); % supply a figure title
```



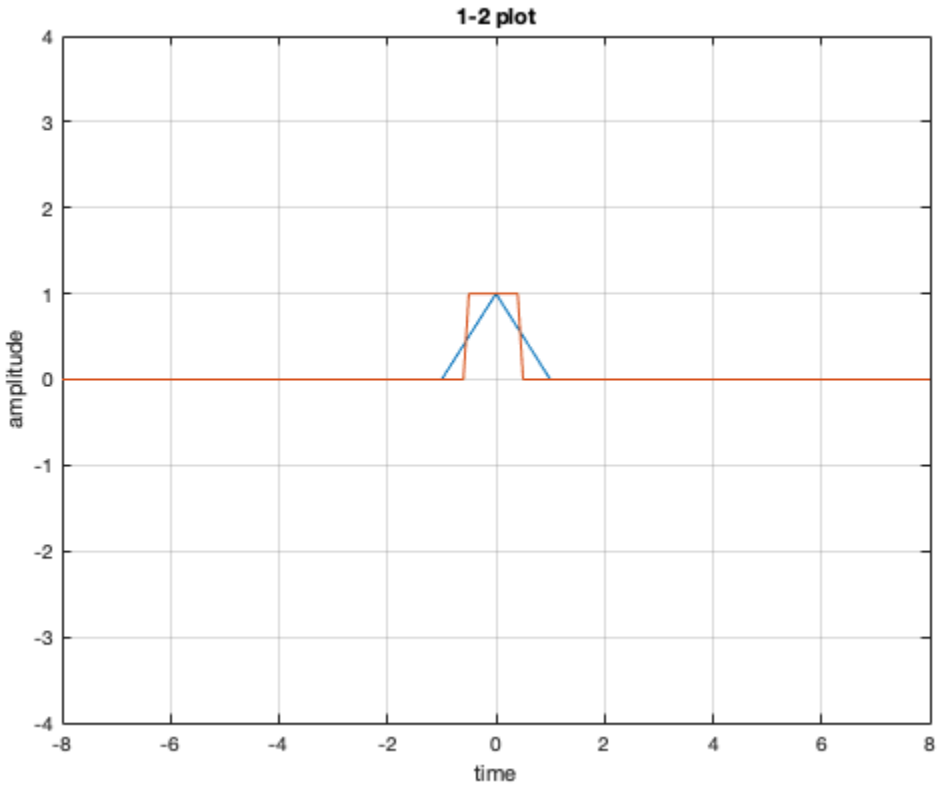
Question 3

```
length(s);
% The length is 16001
index1 = find(t==0);
% The index of the signal vector at t=0 is 8001
```

Question 4

```
figure(2); % start a new figure
t=-8:0.1:8; % define a time axis
s = rectpuls(t); % unit rectangle
l=-8:1:8; % define a time axis
g = rectpuls(l); % unit rectangle
plot(l,g);
hold on
plot(t,s); % create plot
grid on; % add grid lines
axis([-8 8 -4 4]); % scale the display axes
xlabel('time'); % supply a x-axis label
ylabel('amplitude'); % supply a y-axis label
title('1-2 plot'); % supply a figure title
hold off
```

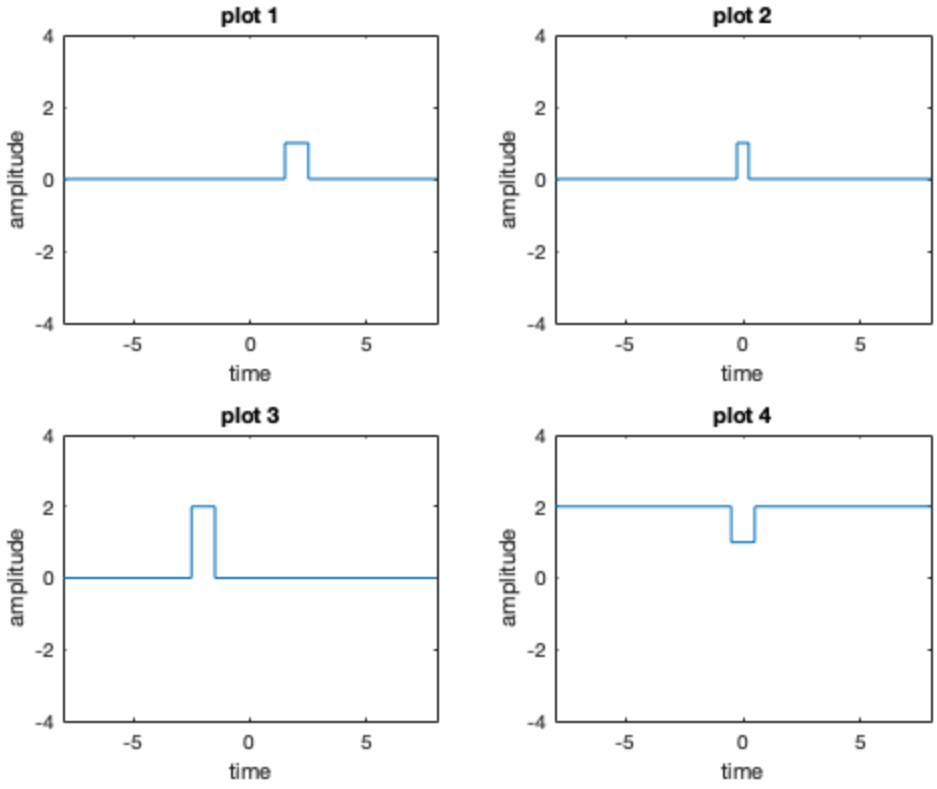
```
% As the number of discrete values in the 't' array decreases, the
% accurracy of each rect fucntion decreases as well.  The more indexes
 the
%'t' array has, the more close to the ideal rect function you will
 get.
```



Question 5

```
clear all;
close all;
clf;
figure(3);
t=-8:0.001:8; % define a time axis
s1 = rectpuls(t-2);
s2 = rectpuls(2*t);
s3 = 2*rectpuls(-t-2);
s4 = -rectpuls(t) + 2;

subplot(2,2,1); % create plot
plot(t,s1);
title('plot 1'); % supply a figure title
axis([-8 8 -4 4]); % scale the display axes
xlabel('time'); % supply a x-axis label
ylabel('amplitude'); % supply a y-axis label

subplot(2,2,2); % create plot
```

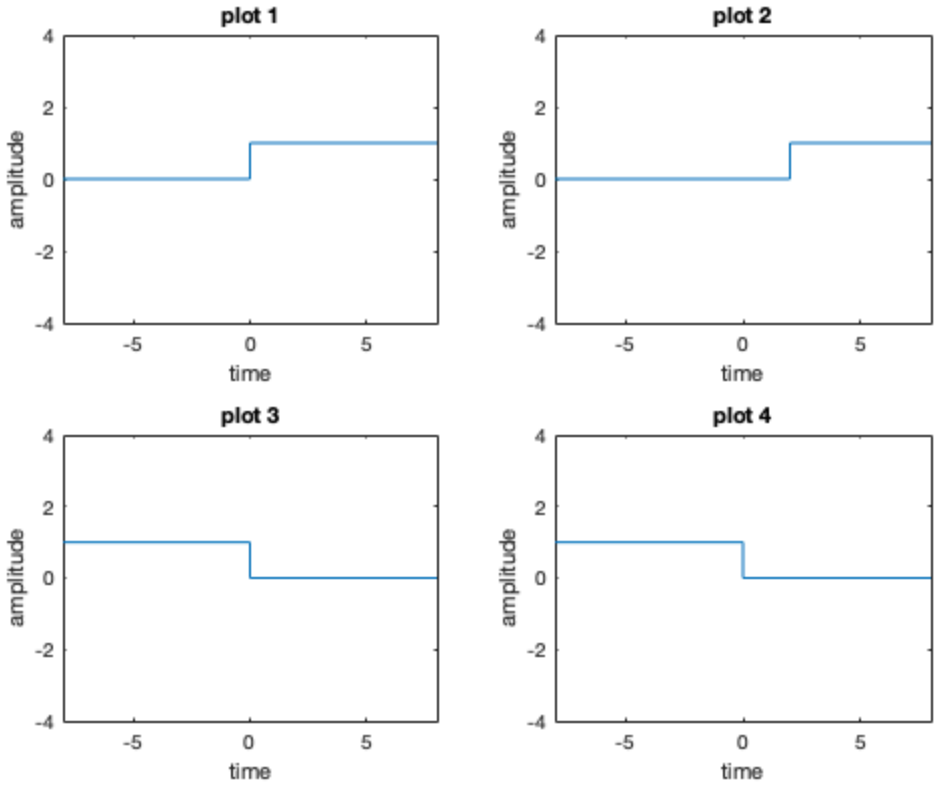
```
plot(t,s2);
title('plot 2'); % supply a figure title
axis([-8 8 -4 4]); % scale the display axes
xlabel('time'); % supply a x-axis label
ylabel('amplitude'); % supply a y-axis label

subplot(2,2,3); % create plot
plot(t,s3);
title('plot 3'); % supply a figure title
axis([-8 8 -4 4]); % scale the display axes
xlabel('time'); % supply a x-axis label
ylabel('amplitude'); % supply a y-axis label

subplot(2,2,4); % create plot
plot(t,s4);
title('plot 4'); % supply a figure title
axis([-8 8 -4 4]); % scale the display axes
xlabel('time'); % supply a x-axis label
ylabel('amplitude'); % supply a y-axis label
```



Question 6

```
clear all;
close all;
clf;
figure(3);
t=-8:0.001:8; % define a time axis
syms x
s1 = heaviside(t); %step function 1
s2 = heaviside(t-2);
s3 = heaviside(-t);
s4 = -heaviside(t)+1;

subplot(2,2,1); % create plot
plot(t,s1);
title('plot 1'); % supply a figure title
axis([-8 8 -4 4]); % scale the display axes
xlabel('time'); % supply a x-axis label
ylabel('amplitude'); % supply a y-axis label

subplot(2,2,2); % create plot
plot(t,s2);
title('plot 2'); % supply a figure title
axis([-8 8 -4 4]); % scale the display axes
xlabel('time'); % supply a x-axis label
```

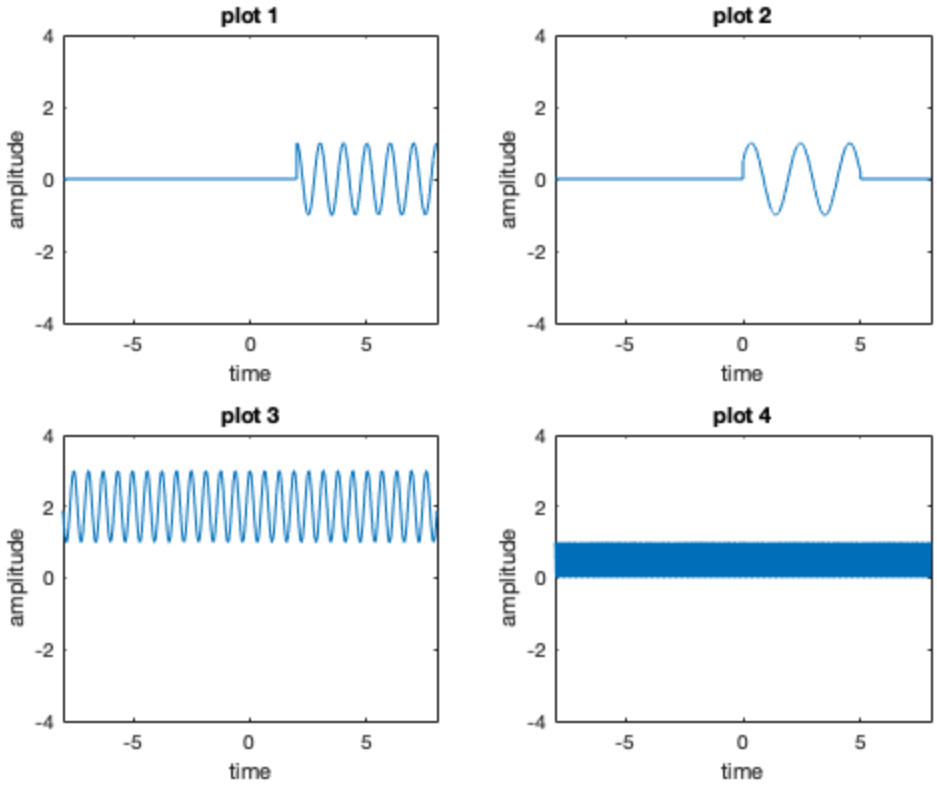
```
ylabel('amplitude'); % supply a y-axis label

subplot(2,2,3); % create plot
plot(t,s3);
title('plot 3'); % supply a figure title
axis([-8 8 -4 4]); % scale the display axes
xlabel('time'); % supply a x-axis label
ylabel('amplitude'); % supply a y-axis label

subplot(2,2,4); % create plot
plot(t,s4);
title('plot 4'); % supply a figure title
axis([-8 8 -4 4]); % scale the display axes
xlabel('time'); % supply a x-axis label
ylabel('amplitude'); % supply a y-axis label
```



Question 7

```
clear all;
close all;
clf;
figure(4);
t=-8:0.001:8; % define a time axis
syms x
s1 = heaviside(t-2).*cos(2*pi*t);
s2 = rectpuls((t-2.5)/5).* sin(3*t+(pi*(1/6)));
s3 = cos(10*t)+2;
s4 = abs(cos(2*pi*6*t));

subplot(2,2,1); % create plot
plot(t,s1);
title('plot 1'); % supply a figure title
axis([-8 8 -4 4]); % scale the display axes
xlabel('time'); % supply a x-axis label
ylabel('amplitude'); % supply a y-axis label

subplot(2,2,2); % create plot
plot(t,s2);
title('plot 2'); % supply a figure title
axis([-8 8 -4 4]); % scale the display axes
xlabel('time'); % supply a x-axis label
```

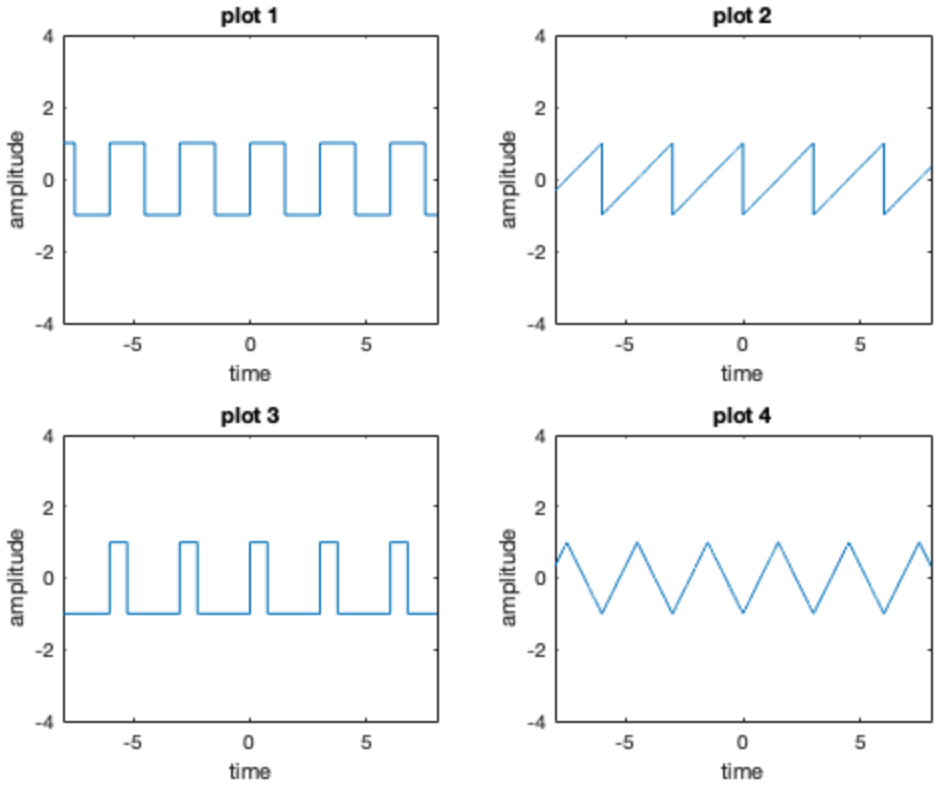
```
ylabel('amplitude'); % supply a y-axis label

subplot(2,2,3); % create plot
plot(t,s3);
title('plot 3'); % supply a figure title
axis([-8 8 -4 4]); % scale the display axes
xlabel('time'); % supply a x-axis label
ylabel('amplitude'); % supply a y-axis label

subplot(2,2,4); % create plot
plot(t,s4);
title('plot 4'); % supply a figure title
axis([-8 8 -4 4]); % scale the display axes
xlabel('time'); % supply a x-axis label
ylabel('amplitude'); % supply a y-axis label
```



Question 8

```
clear all;
close all;
clf;
figure(5);
t=-8:0.001:8; % define a time axis
syms x
s1 = square(2*pi*t*1/3); %square wave
s2 = sawtooth(2*pi*t*1/3); %sawtooth wave
s3 = square(2*pi*t*1/3,25); % rectangular wave with 25% duty cycle
s4 = sawtooth(2*pi*t*1/3,0.5); %triangle wave

subplot(2,2,1); % create plot
plot(t,s1);
title('plot 1'); % supply a figure title
axis([-8 8 -4 4]); % scale the display axes
xlabel('time'); % supply a x-axis label
ylabel('amplitude'); % supply a y-axis label

subplot(2,2,2); % create plot
plot(t,s2);
title('plot 2'); % supply a figure title
axis([-8 8 -4 4]); % scale the display axes
xlabel('time'); % supply a x-axis label
```

```
ylabel('amplitude'); % supply a y-axis label

subplot(2,2,3); % create plot
plot(t,s3);
title('plot 3'); % supply a figure title
axis([-8 8 -4 4]); % scale the display axes
xlabel('time'); % supply a x-axis label
ylabel('amplitude'); % supply a y-axis label

subplot(2,2,4); % create plot
plot(t,s4);
title('plot 4'); % supply a figure title
axis([-8 8 -4 4]); % scale the display axes
xlabel('time'); % supply a x-axis label
ylabel('amplitude'); % supply a y-axis label
```



Question 9

```
% See attached file 'stimpulse.m' for Question 9
```

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```
%%The following code should be run in the editor:
%t = 0:0.00001:1;

function sigtot=stimpulse(t)

pps = 1000; % the number of pulses per second
syms x
w1 = 0.00004; %positive pulse width
w2 = 0.00004; %negative pulse width
duty1=w1*pps*100; %positive pulse duty
duty2=w2*pps*100; %negative pulse duty
sig1= (0.5)*square(2*pi*pps*t,duty1)+ 0.5; %positive part of the
 signal
sig2= (-0.5)*square(2*pi*pps*(t-w1),duty2) - 0.5; %positive part of
 the signal
sigtot = sig1 + sig2; %total signal output

end

%%The following code should be run in the editor:
%t = 0:0.00001:1;
%plot(t,stimpulse(t));
%grid on;
%axis([0 1 0 1]);
%xlabel('time');
%ylabel('amplitude');
%title('1-2 plot');
```

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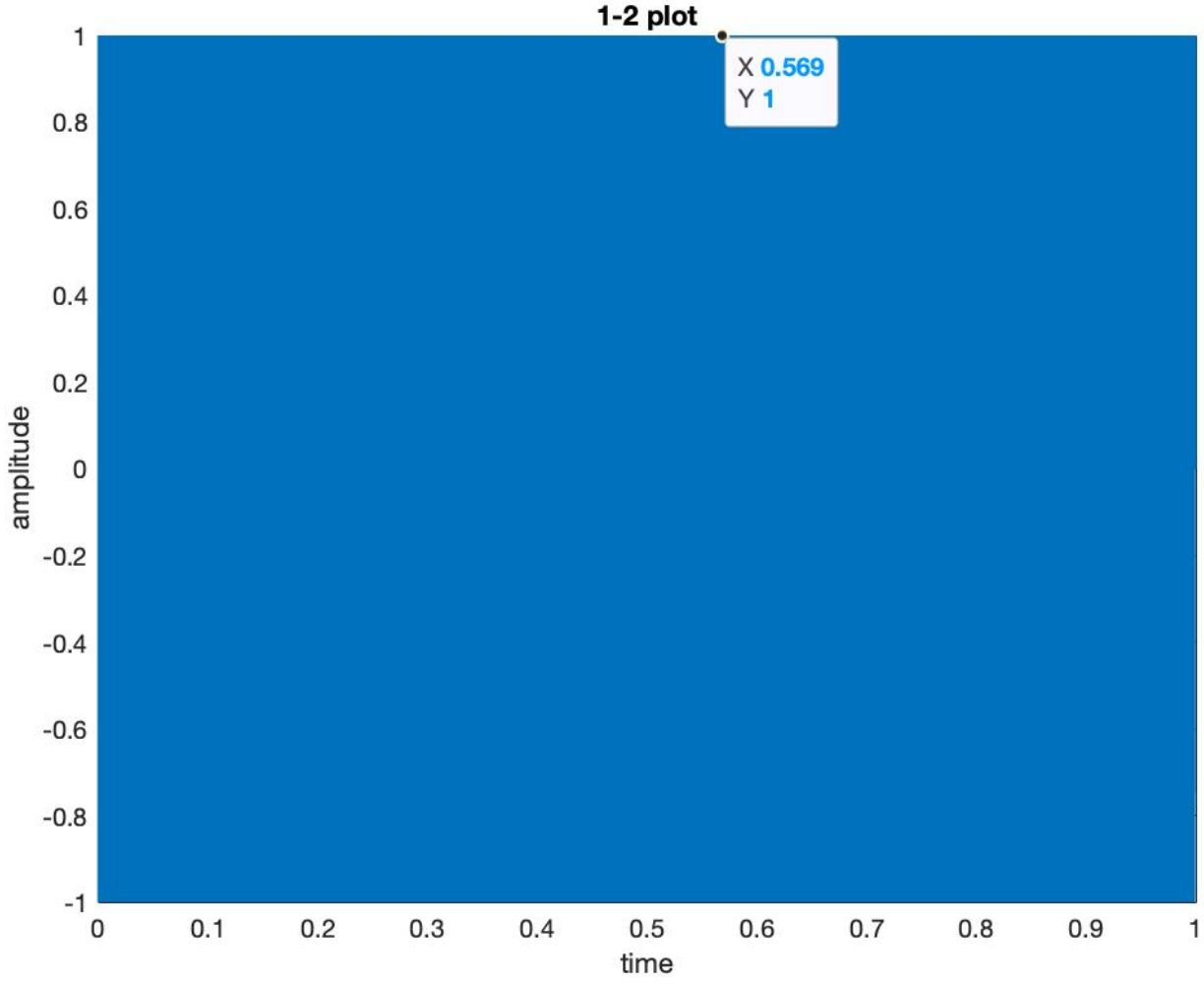
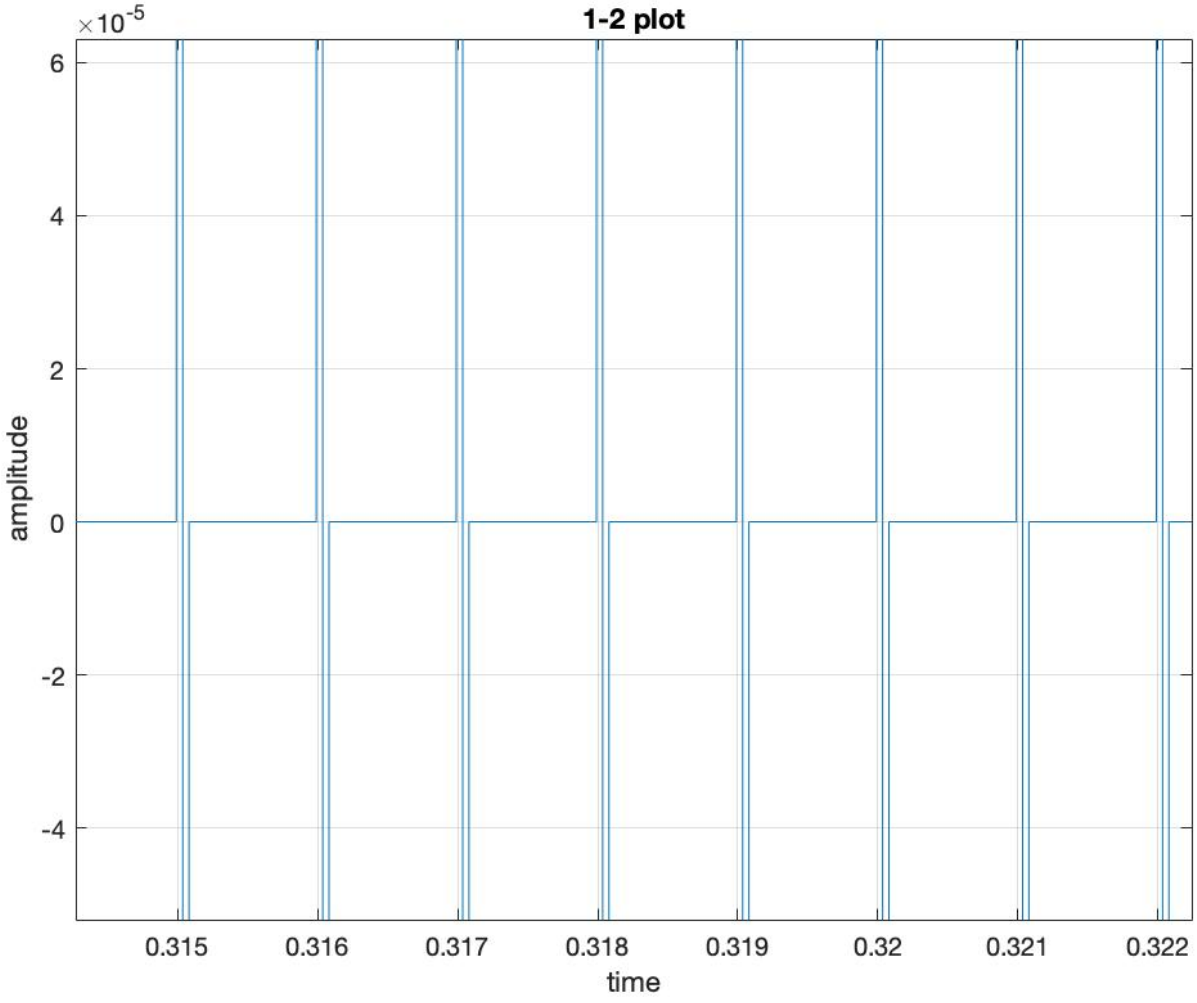

1-2 plot
X 0.569
Y 1
amplitude
time
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


1-2 plot
×10^-5
6
4
2
0
-2
-4
amplitude
0.315
0.316
0.317
0.318
0.319
0.32
0.321
0.322
time