CARNEGIE MELLON UNIVERSITY
APPLIED STOCHASTIC PROCESSES
(COURSE 18-751)
HOMEWORK 13

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I collaborated with :

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2.b

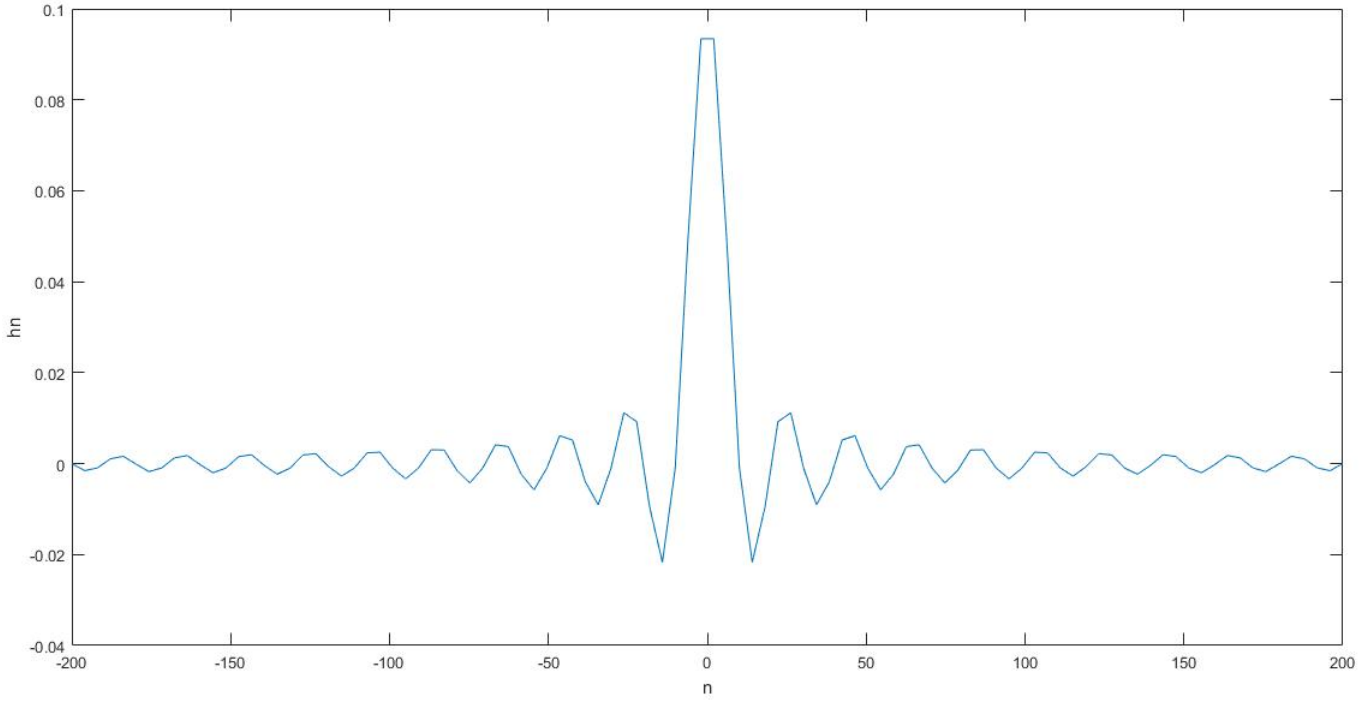

Figure 1: h_n

2.c

Comment on the apparent bandwidth of the system in all three cases
The bandwidth increases as we consider more and more parts of the impulse response(filter) i.e as c increases.

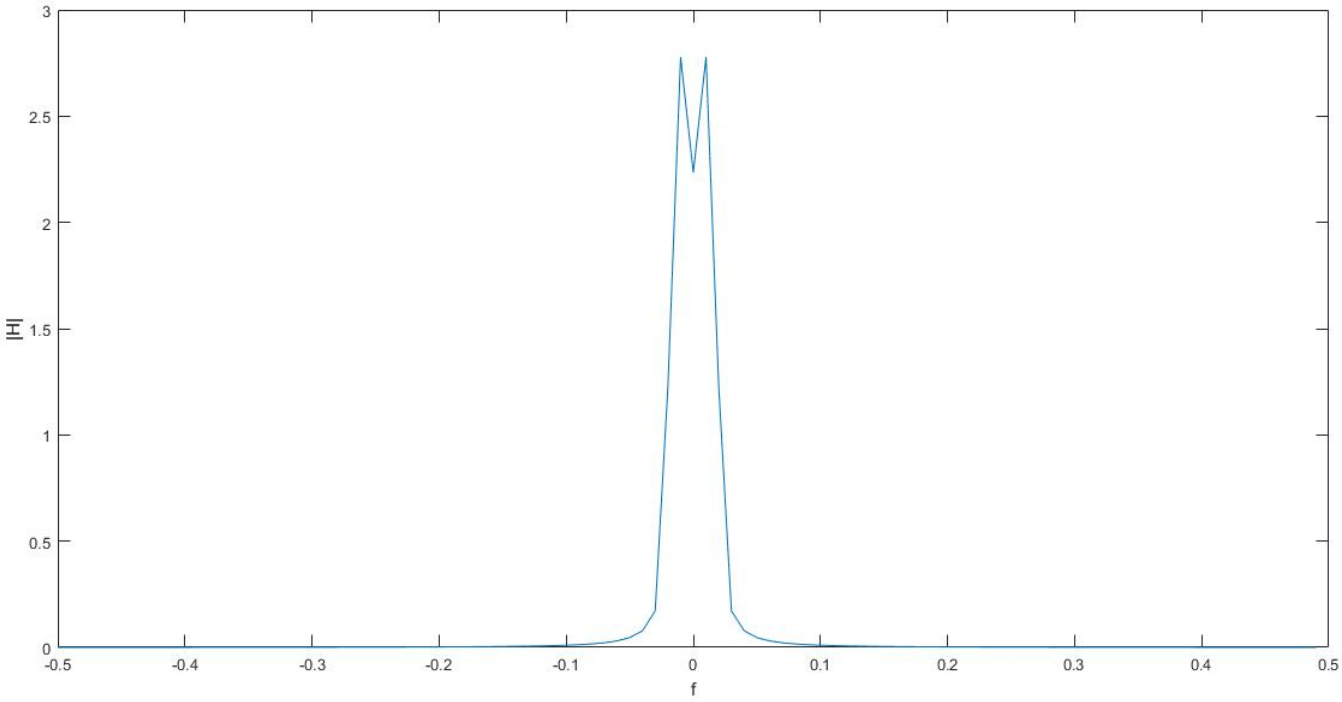

Figure 2: random sequence of impulses

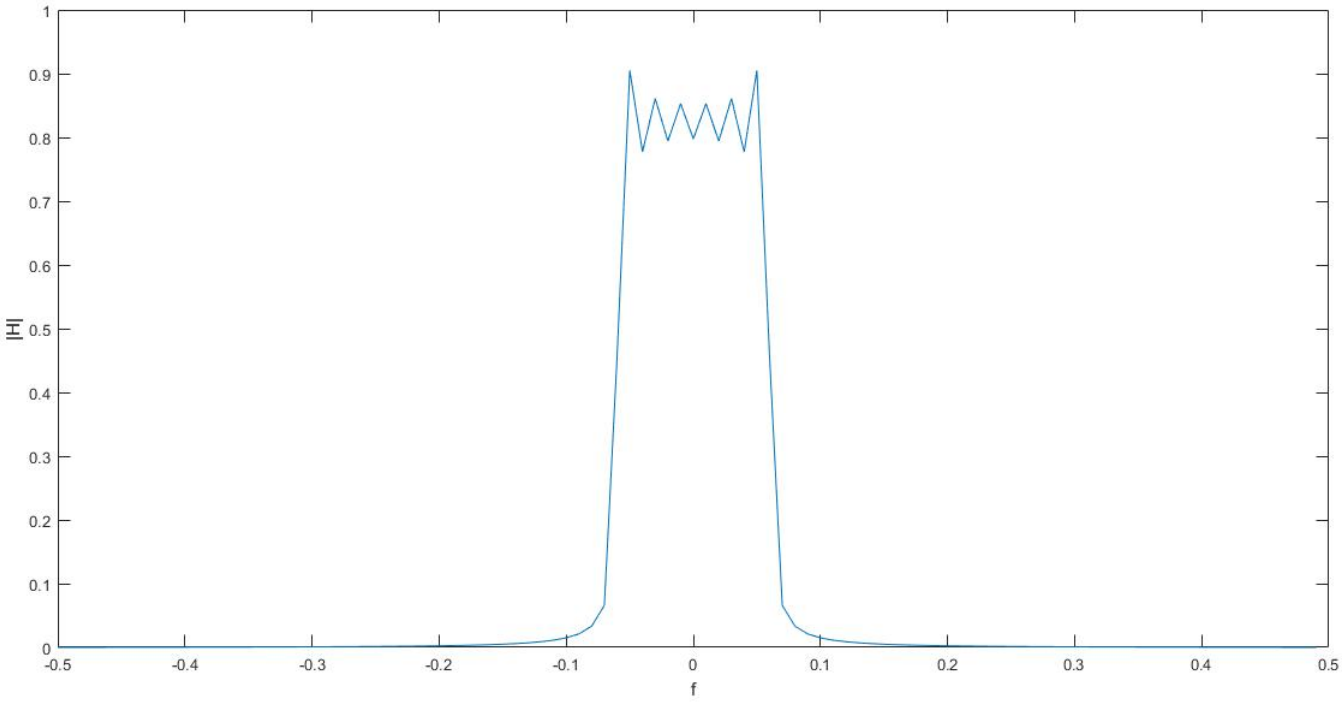

Figure 3: random sequence of impulses

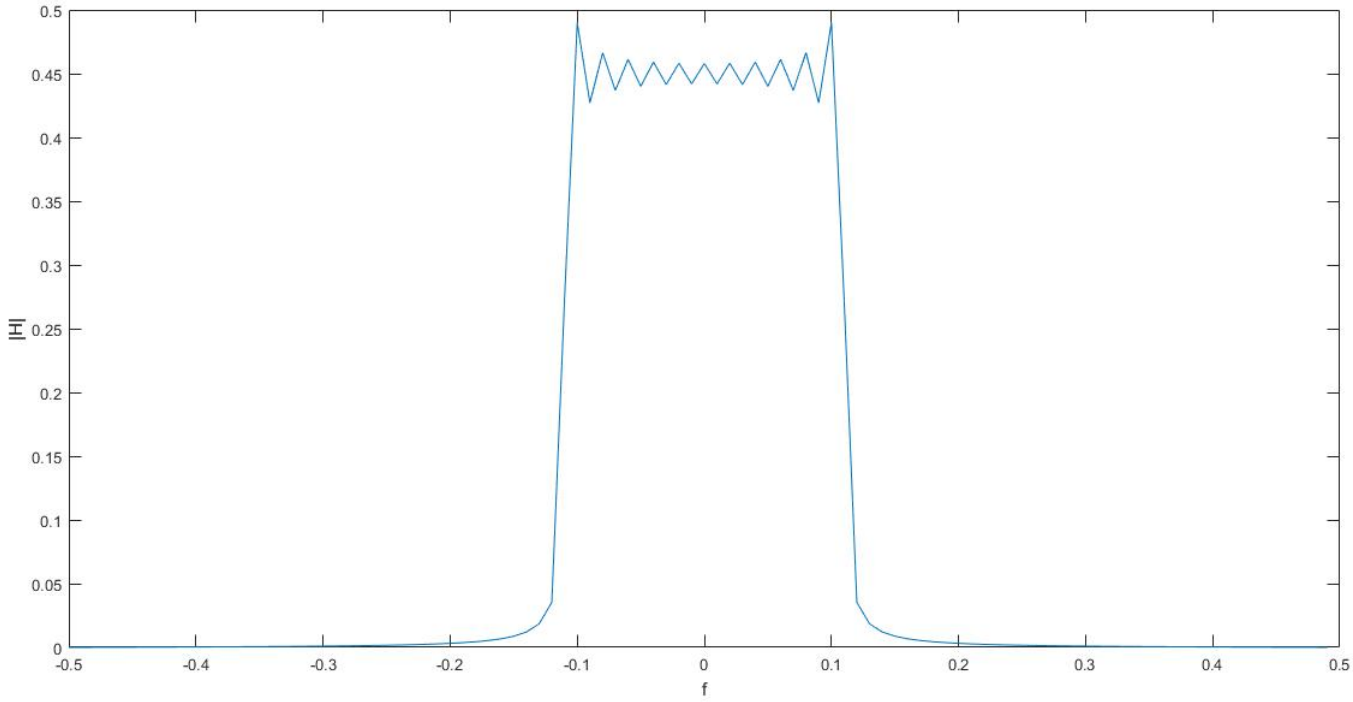

Figure 4: random sequence of impulses

2.d

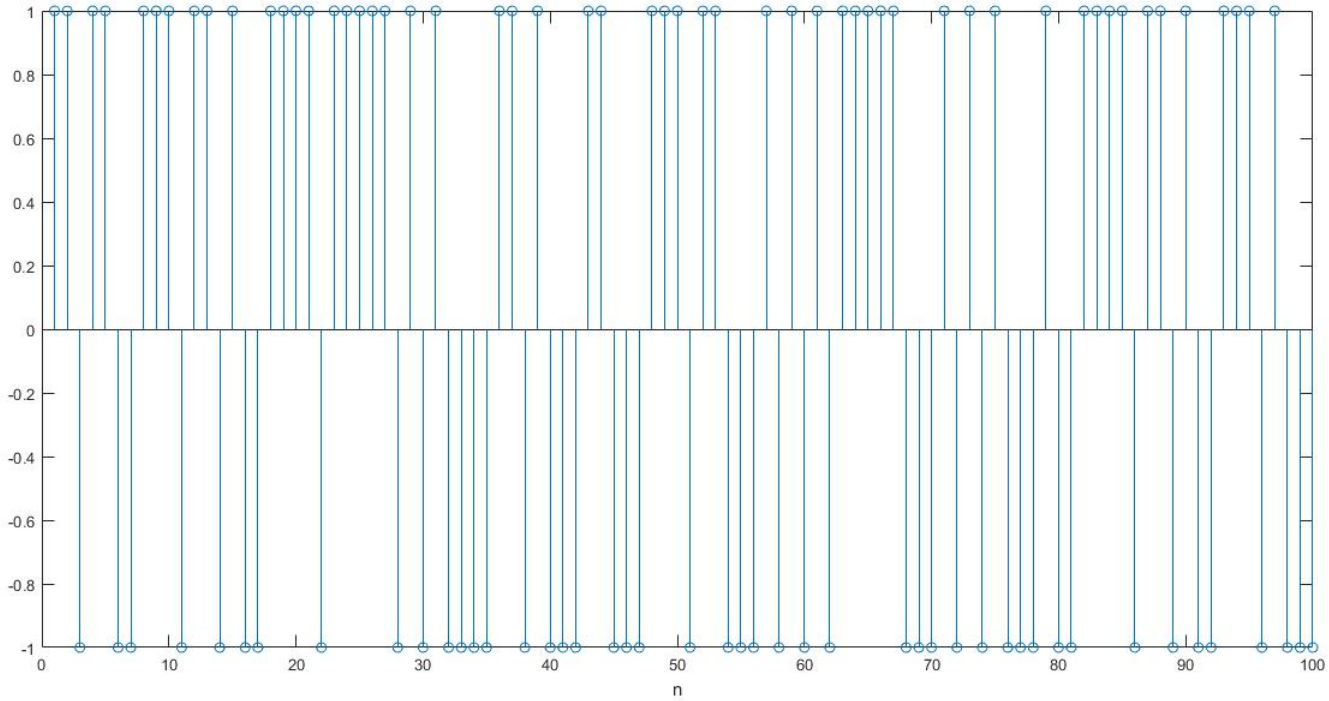

Figure 5: random sequence of impulses

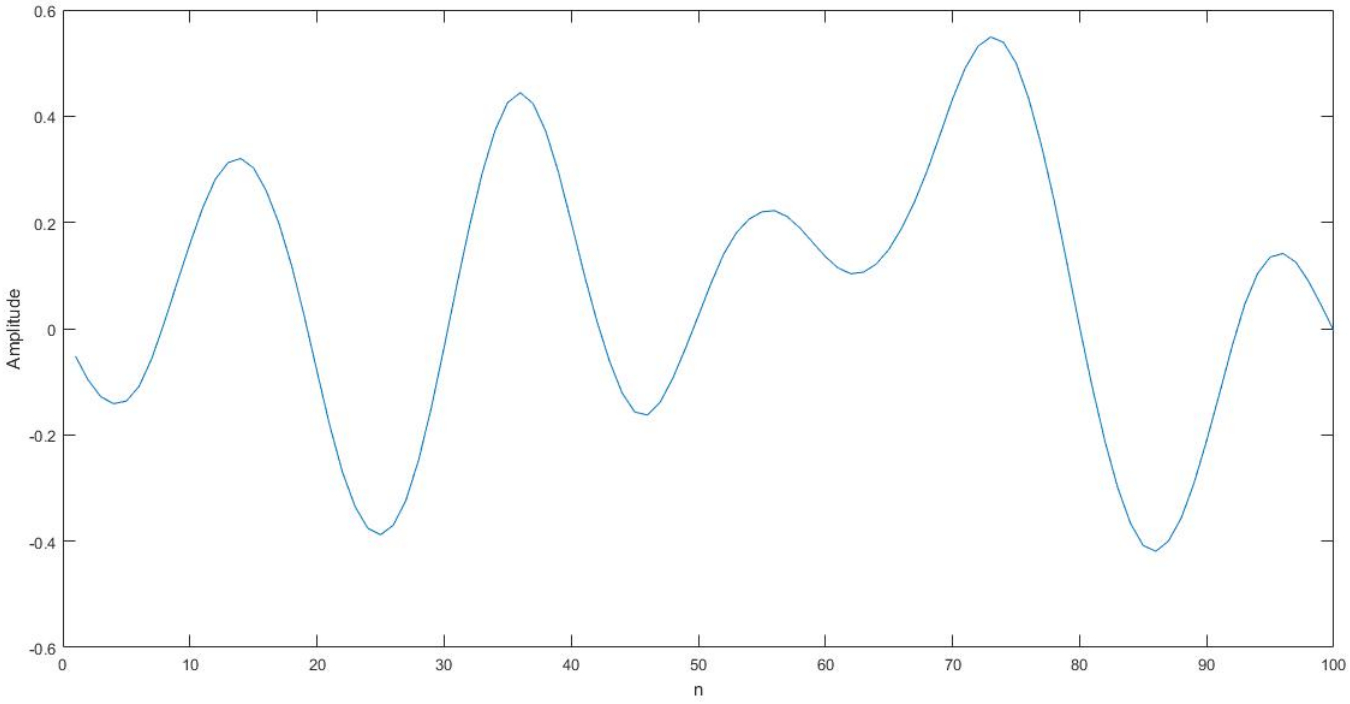

Figure 6: random sequence of pulses

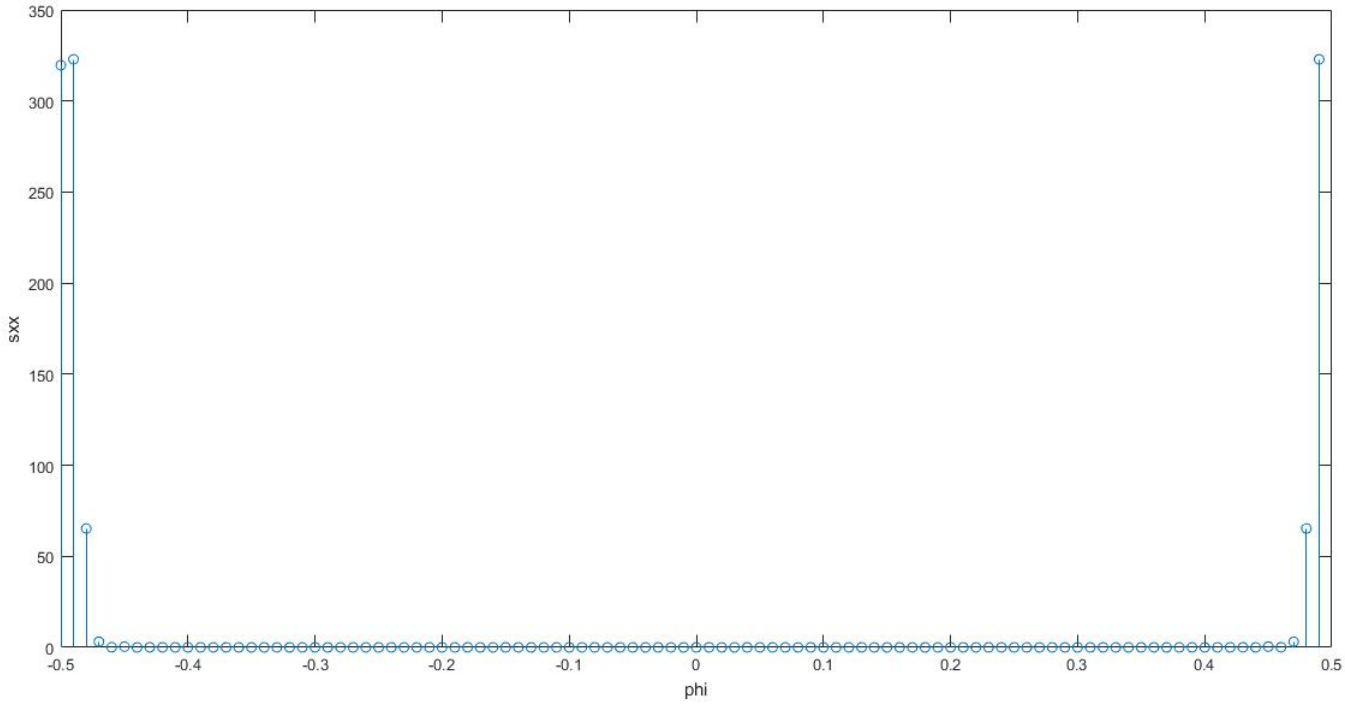

Figure 7: $SXX(\phi)$ $c = 2$

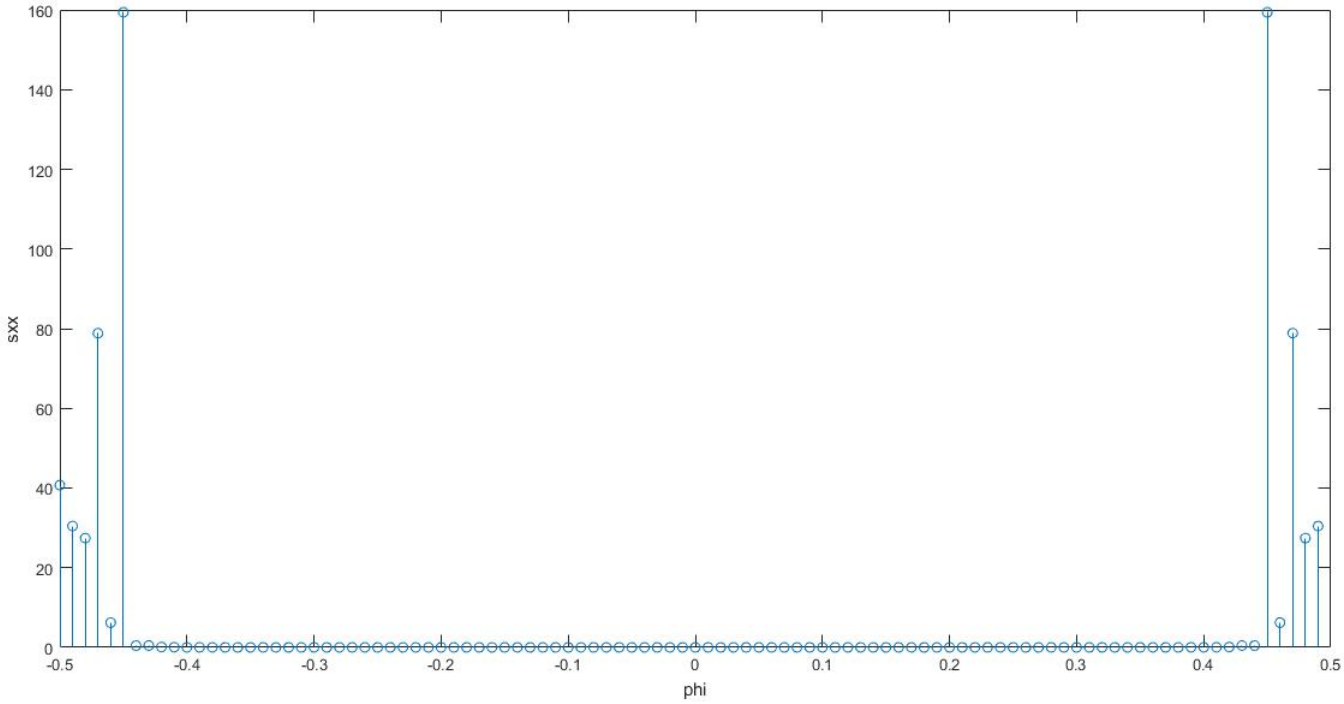

Figure 8: $SXX(\phi)$ $c = 5$

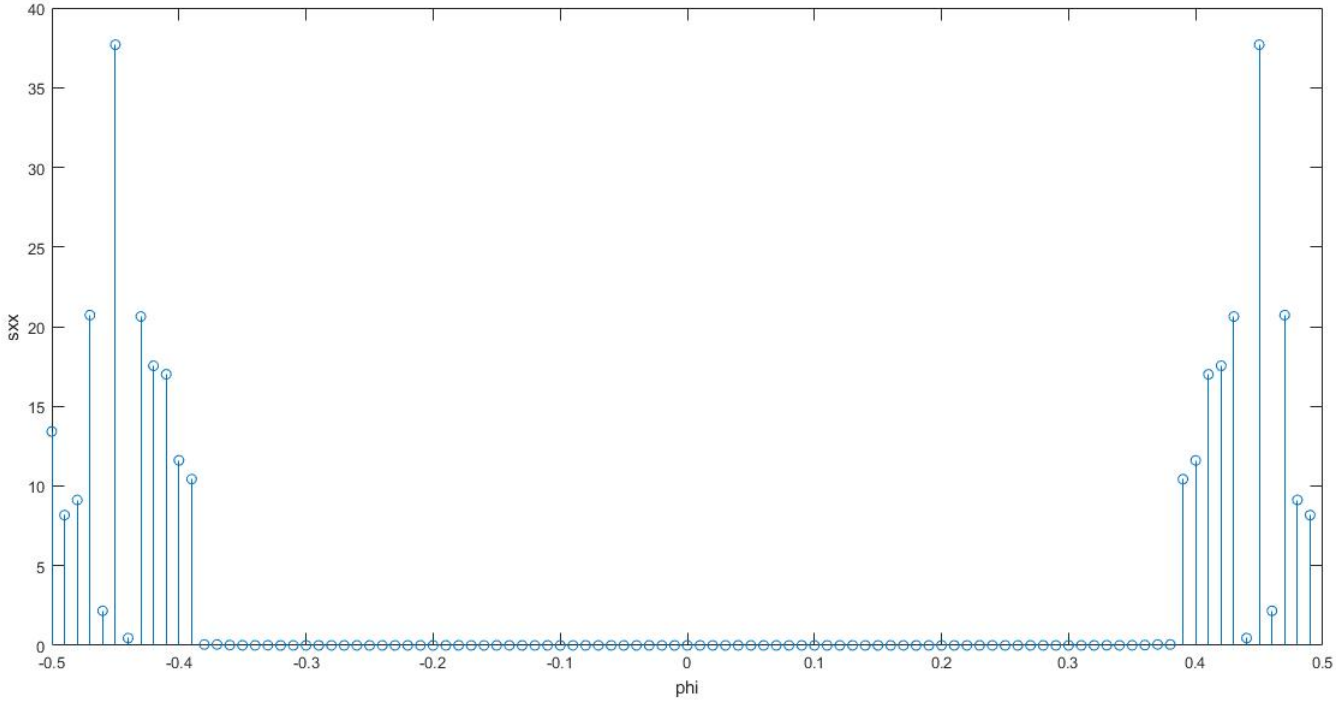

Figure 9: $SXX(\phi)$ $c = 10$

Code Appendix

```
clear;
clc;
close all;

fe = 0.05;
n = linspace(-200,200);
h = 2*fe*sinc(2*fe*n);
figure;
plot(n,h);
xlabel('n')
ylabel('hn')
%c=2
n = linspace(-20,20);
h = 2*fe*sinc(2*fe*n);
figure;
plot(n,h);
xlabel('n')
ylabel('hn')
dtft = fft (h);
dtft = fftshift (abs(dtft));
fc = (-numel(dtft)/2:numel(dtft)/2-1)./numel(dtft);
figure;
plot(fc,dtft);
xlabel('f');
ylabel('|H|');
%c=5
n = linspace(-60,60);
h = 2*fe*sinc(2*fe*n);
figure;
plot(n,h);
xlabel('n')
ylabel('hn')
dtft = fft (h);
dtft = fftshift (abs(dtft));
fc = (-numel(dtft)/2:numel(dtft)/2-1)./numel(dtft);
figure;
plot(fc,dtft);
xlabel('f');
ylabel('|H|');
%c=10
n = linspace(-110,110);
h = 2*fe*sinc(2*fe*n);
figure;
plot(n,h);
xlabel('n')
ylabel('hn')
dtft = fft (h);
dtft = fftshift (abs(dtft));
fc = (-numel(dtft)/2:numel(dtft)/2-1)./numel(dtft);
figure;
plot(fc,dtft);
```

```
xlabel('f');
ylabel('|H|');
%last part
iidp = zeros(1,100);
for i=1:100
flip = discrete([1,1]);
if(flip==2)
iidp(i) = 1;
else
iidp(i) = -1;
end
end

%c=5
n = linspace(-60,60);
h = 2*fe*sinc(2*fe*n);
figure;
stem(iidp)
xlabel('n');
iidpft  = fft(iidp);
filterdFt = iidpft.*fft(h);
filteredDt = ifft(filterdFt);
figure;
plot(filteredDt);
xlabel('n');
ylabel('Amplitude')

%c=2
n = linspace(-20,20);
h = 2*fe*sinc(2*fe*n);
figure;
stem(iidp)
xlabel('n');
iidpft  = fft(iidp);
filterdFt = iidpft.*fft(h);
filteredDt = ifft(filterdFt);
figure;
plot(filteredDt);
sxx = (abs(iidpft).^2).*(abs(fft(h))).^2;
x = -0.5:0.01:0.49;
figure;
stem(x,sxx);
xlabel('phi');
ylabel('sxx');

%c=5
n = linspace(-60,60);
h = 2*fe*sinc(2*fe*n);
figure;
stem(iidp)
xlabel('n');
iidpft  = fft(iidp);
filterdFt = iidpft.*fft(h);
filteredDt = ifft(filterdFt);
```

```
figure;
plot(filteredDt);
sxx = (abs(iidpft).^2).*(abs(fft(h))).^2;
x = -0.5:0.01:0.49;
figure;
stem(x,sxx);
xlabel('phi');
ylabel('sxx');
%c=10
n = linspace(-110,110);
h = 2*fe*sinc(2*fe*n);
figure;
stem(iidp)
xlabel('n');
iidpft  = fft(iidp);
filterdFt = iidpft.*fft(h);
filteredDt = ifft(filterdFt);
figure;
plot(filteredDt);
sxx = (abs(iidpft).^2).*(abs(fft(h))).^2;
x = -0.5:0.01:0.49;
figure;
stem(x,sxx);
xlabel('phi');
ylabel('sxx');
```