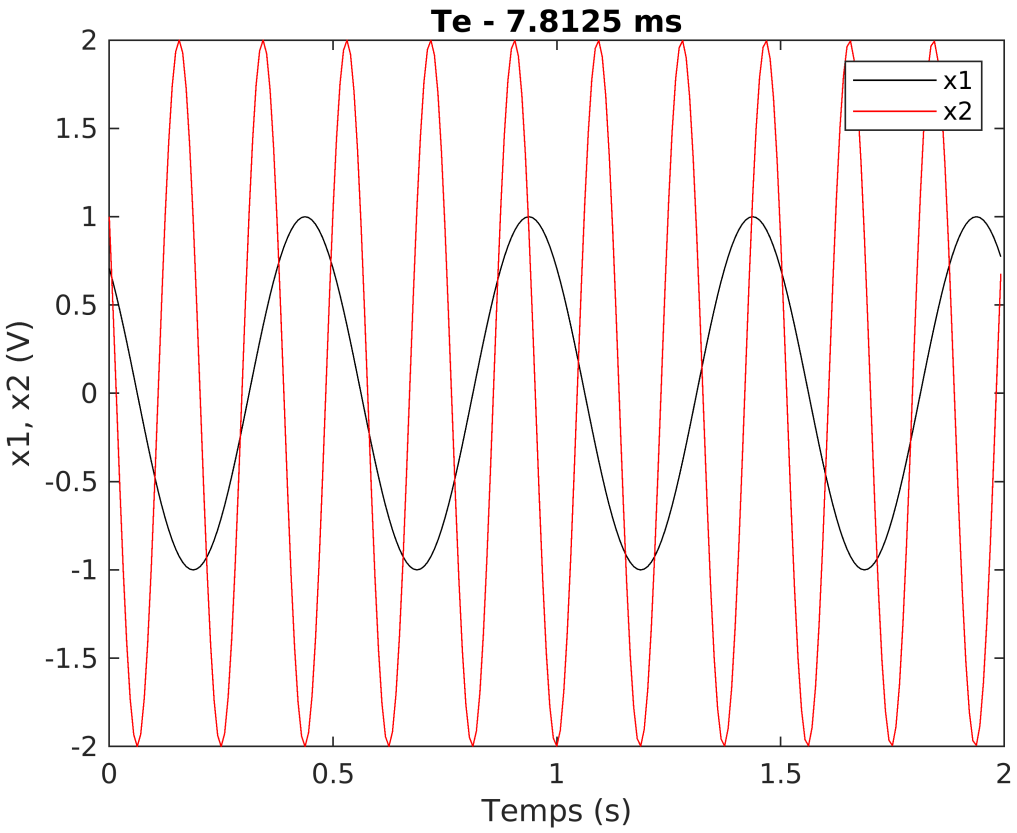
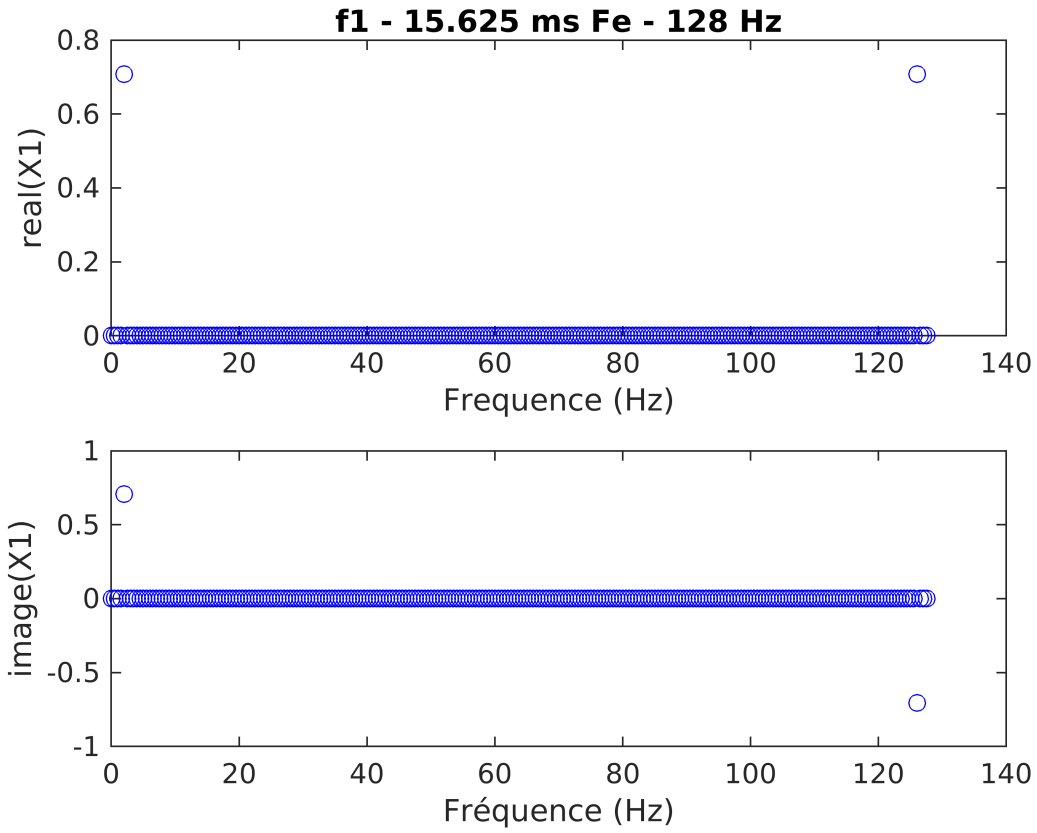
```
close all;
clear all;

f1 = 2;          %fréquence du signal x1
f2 = 5.34;       %fréquence diu signal x2
w1 = 2*pi*f1;    %pulsation signal x1
w2 = 2*pi*f2;    %pulsation signal x2
T1 = 1/f1;       %Periode sginal x1
T2 = 1/f2;       %Periode sginal x1
p1 = pi/4;       %Dephasage du signal x1
p2 = pi/3;       %Dephasage du signal x1

N = 256;
Te  = 2/N;
Fe = 1/T2;

%Question h
%Fe = 3.2;
%Te = 1/Fe;
%N = 32;


Tmax = (N-1)*Te;
time= 0:Te:Tmax;

x1 = cos(w1*time+p1);
x2 = 2*cos(w2*time+p2);

freq = (0:N-1)/(N*Te);

fx1 = fft(x1,N)*Te;
fx2 = fft(x2,N)*Te;

figure(1)
plot(time,x1,'k',time,x2,'r');
xlabel('Temps (s)');
ylabel('x1, x2 (V)');
legend('x1','x2');
title(sprintf('Te - %g ms',Te*1e3));
```



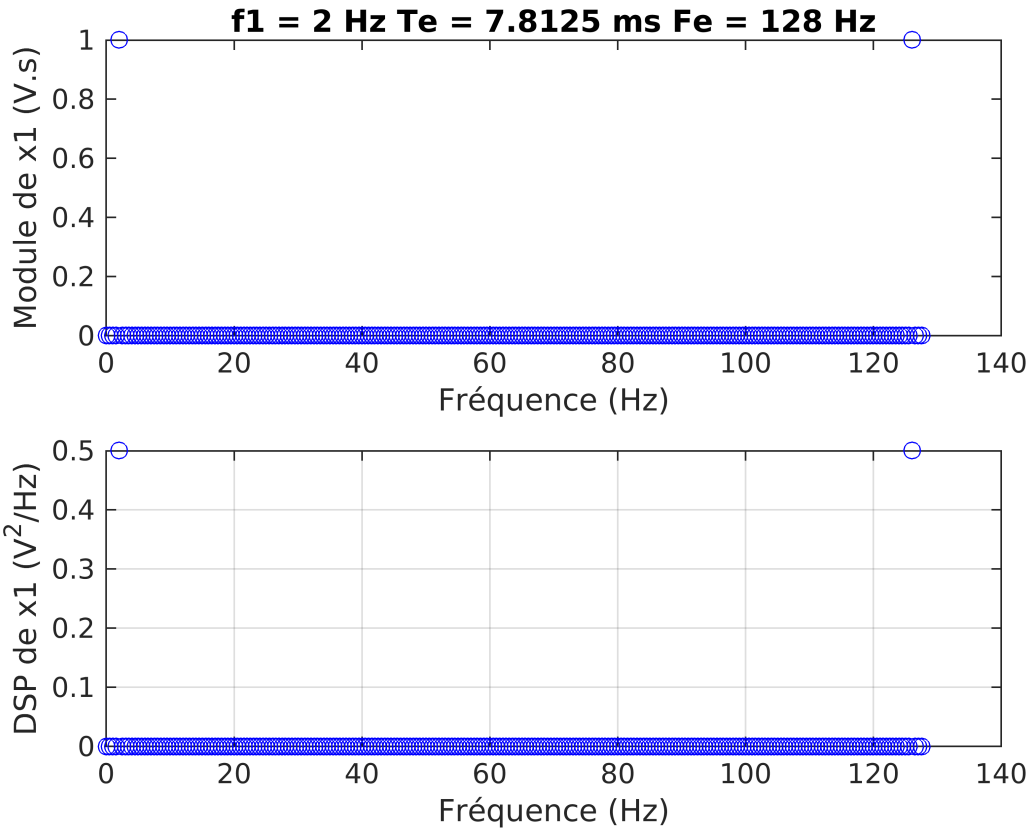

```
figure(2)
subplot(2,1,1);
plot(freq,real(fx1),'bo');
title(sprintf('f1 - %g ms Fe - %g Hz',f1*Te*1e3,1/Te));
xlabel('Frequence (Hz)');
ylabel('real(X1)');
subplot(2,1,2);
plot(freq,imag(fx1),'bo');
xlabel('Fréquence (Hz)');
 ylabel('image(X1)');
```



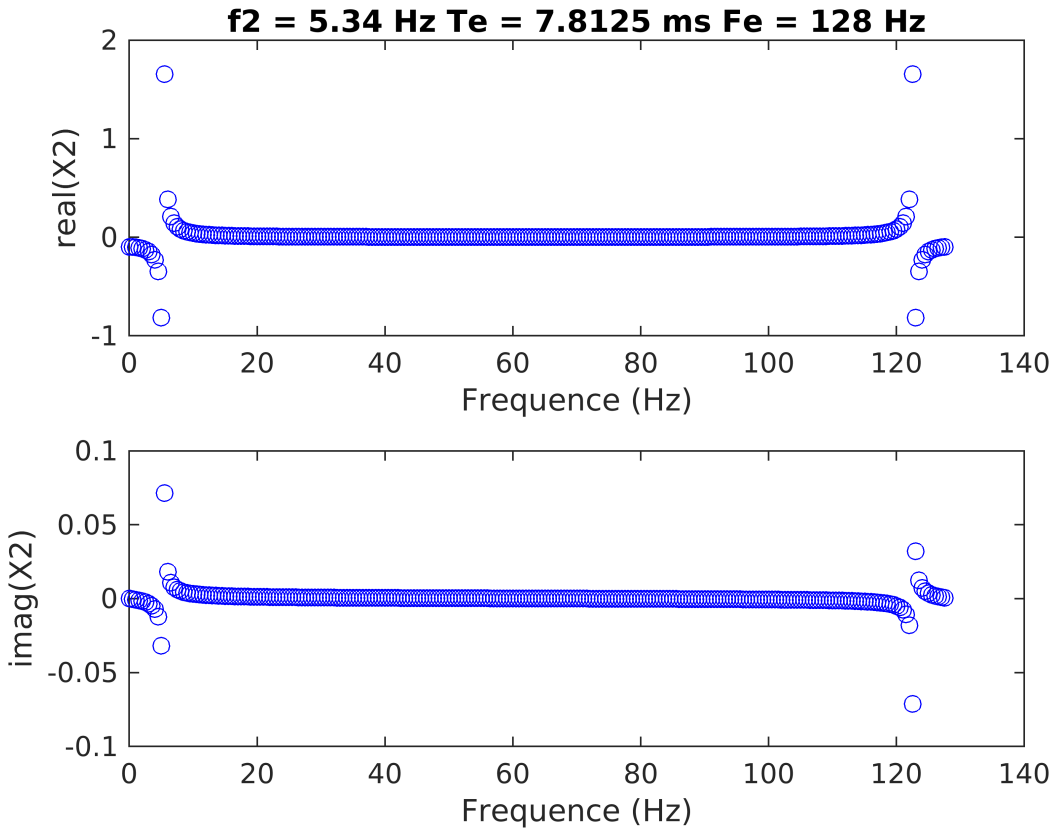

```
figure(3)
subplot(2,1,1);
plot(freq,abs(fx1),'bo');
title(sprintf('f1 = %g Hz Te = %g ms Fe = %g Hz', f1,Te*1e3,1/Te));
xlabel('Fréquence (Hz)');
ylabel('Module de x1 (V.s)');
DSP1 = conj(fx1).*fx1/(N*Te);
subplot(2,1,2);
plot(freq,DSP1,'bo');
xlabel('Fréquence (Hz)');
ylabel('DSP de x1 (V^2/Hz)');

puiss_f = sum(DSP1)*Fe/N;
puiss_t = x1*x1'/N;
disp(['puissance_x1_freq= ',num2str(puiss_f),' puissance_x1_temp = ',num2str(puiss_t)])
```

```
puissance_x1_freq= 0.020859 puissance_x1_temp = 0.5
```

```
grid on;
```



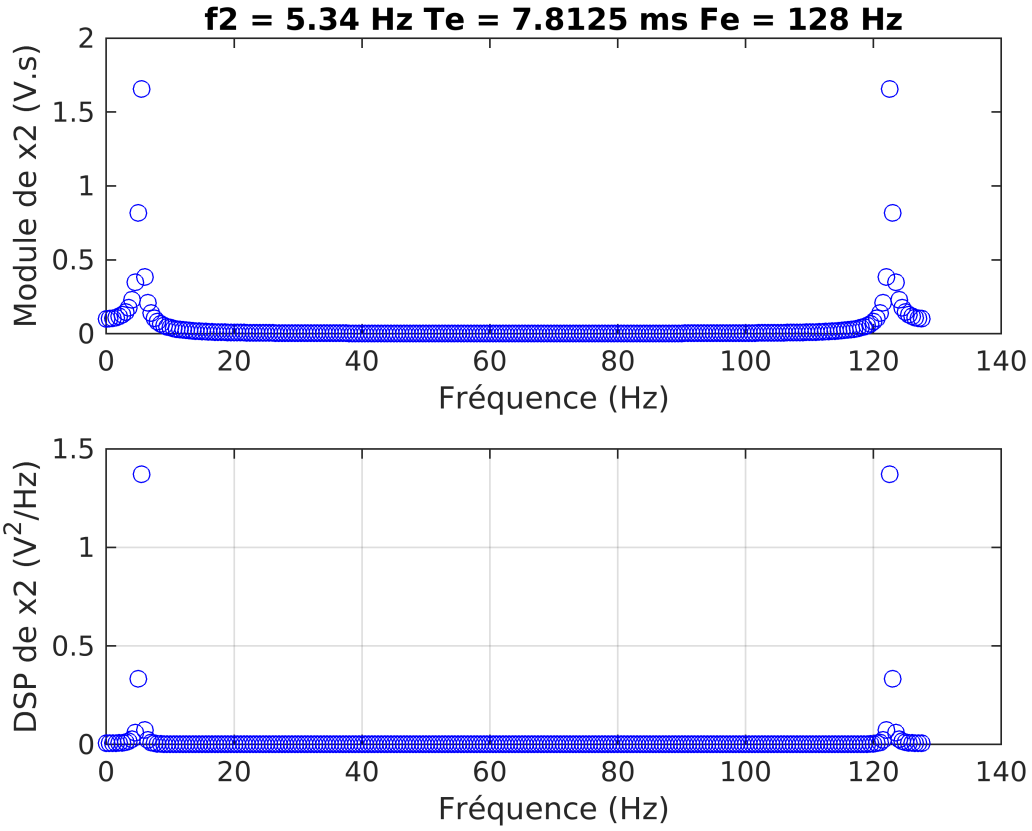

```
figure(4)
subplot(2,1,1);
plot(freq,real(fx2),'bo');
title(sprintf('f2 = %g Hz Te = %g ms Fe = %g Hz', f2,Te*1e3,1/Te));
xlabel('Frequence (Hz)');
ylabel('real(X2)');
subplot(2,1,2);
plot(freq,imag(fx2),'bo');
xlabel('Frequence (Hz)');
 ylabel('imag(X2)');
```



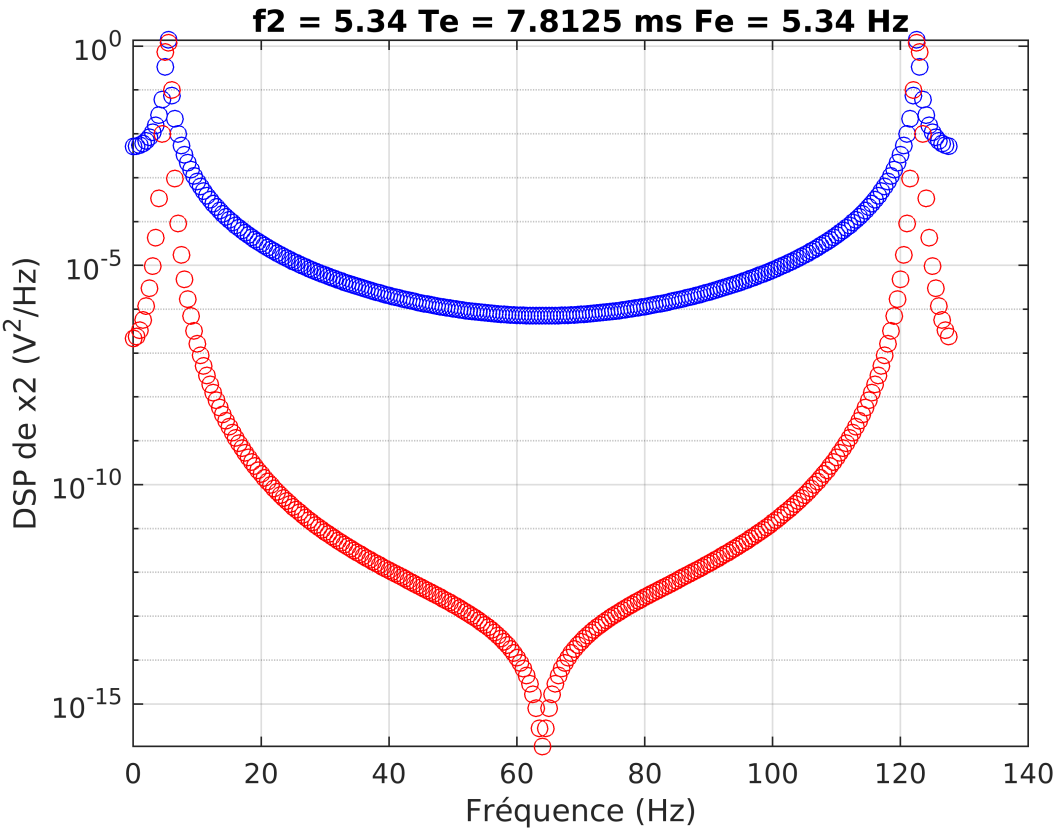

```
figure(5)
subplot(2,1,1);
plot(freq,abs(fx2),'bo');
title(sprintf('f2 = %g Hz Te = %g ms Fe = %g Hz', f2,Te*1e3,1/Te));
xlabel('Fréquence (Hz)');
ylabel('Module de x2 (V.s)');
DSP2 = conj(fx2).*fx2/(N*Te);
subplot(2,1,2);
plot(freq,DSP2,'bo');
xlabel('Fréquence (Hz)');
ylabel('DSP de x1 (V^2/Hz)');
xlabel('Fréquence (Hz)');
ylabel('DSP de x2 (V^2/Hz)');
puiss_f = sum(DSP1)*Fe/N;
puiss_t = x2*x2'/N;
disp(['puissance_x2_freq = ',num2str(puiss_f),' puissance_x2_temp = ',num2str(puiss_t)]
```

```
puissance_x2_freq = 0.020859 puissance_x2_temp = 1.9732
```

```
grid on;
```




```
figure(6)
semilogy(freq,DSP2,'bo');
title(sprintf('f2 = %g Te = %g ms Fe = %g Hz',f2,Te*1e3,1/T2));
xlabel('Fréquence (Hz)');
ylabel('DSP de x2 (V^2/Hz)');
hold on;
x2Hann= x2.*hanning(N)';
fx2Hann= fft(x2Hann,N)*Te;
DSP2Hann = conj(fx2Hann).*fx2Hann/(N*Te);

semilogy(freq,DSP2Hann*8/3,'ro');
xlabel('Fréquence (Hz)');
ylabel('DSP de x2 (V^2/Hz)');
grid on;
hold on;
```


f2 = 5.34 Te = 7.8125 ms Fe = 5.34 Hz
DSP de x2 (V2/Hz)
Fréquence (Hz)
10^0
10^-5
10^-10
10^-15
0
20
40
60
80
100
120
140