

*****Draft*****

FFT Octave

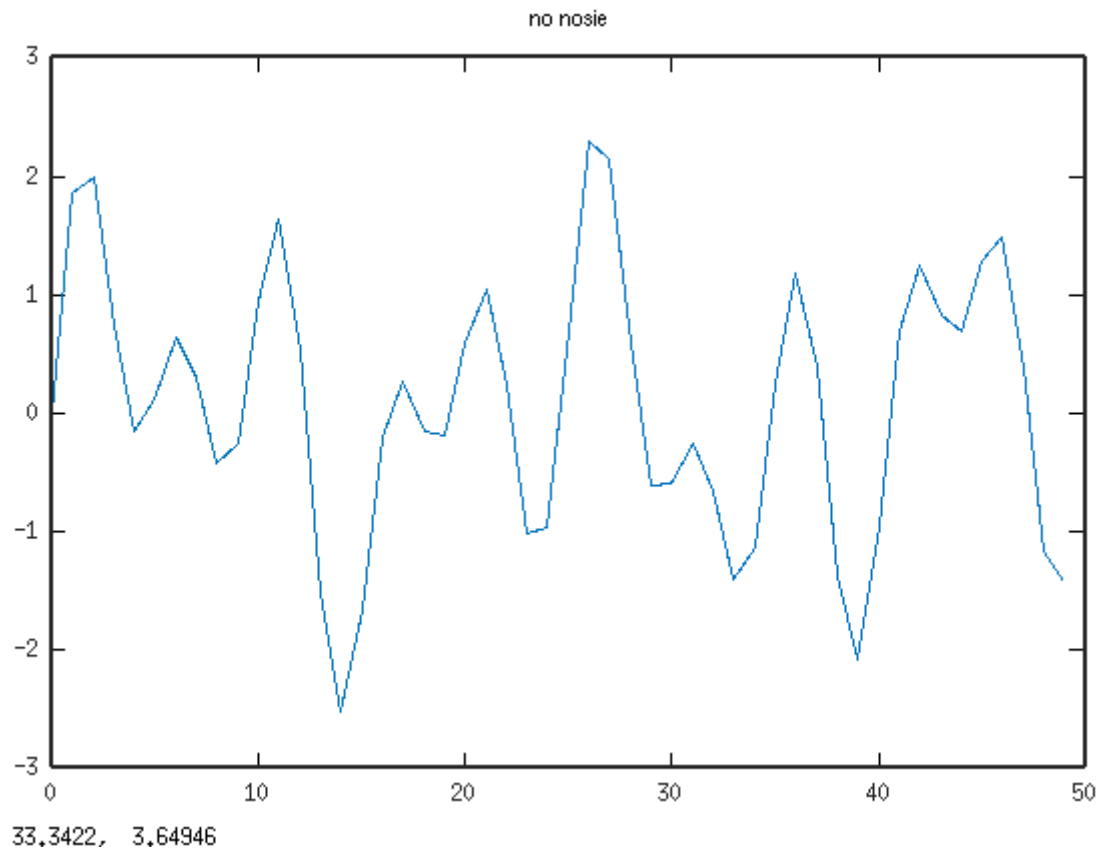
08/25/20

*****Draft*****

Starting with an example in Matlab at “<https://www.mathworks.com/help/matlab/ref/fft.html>”

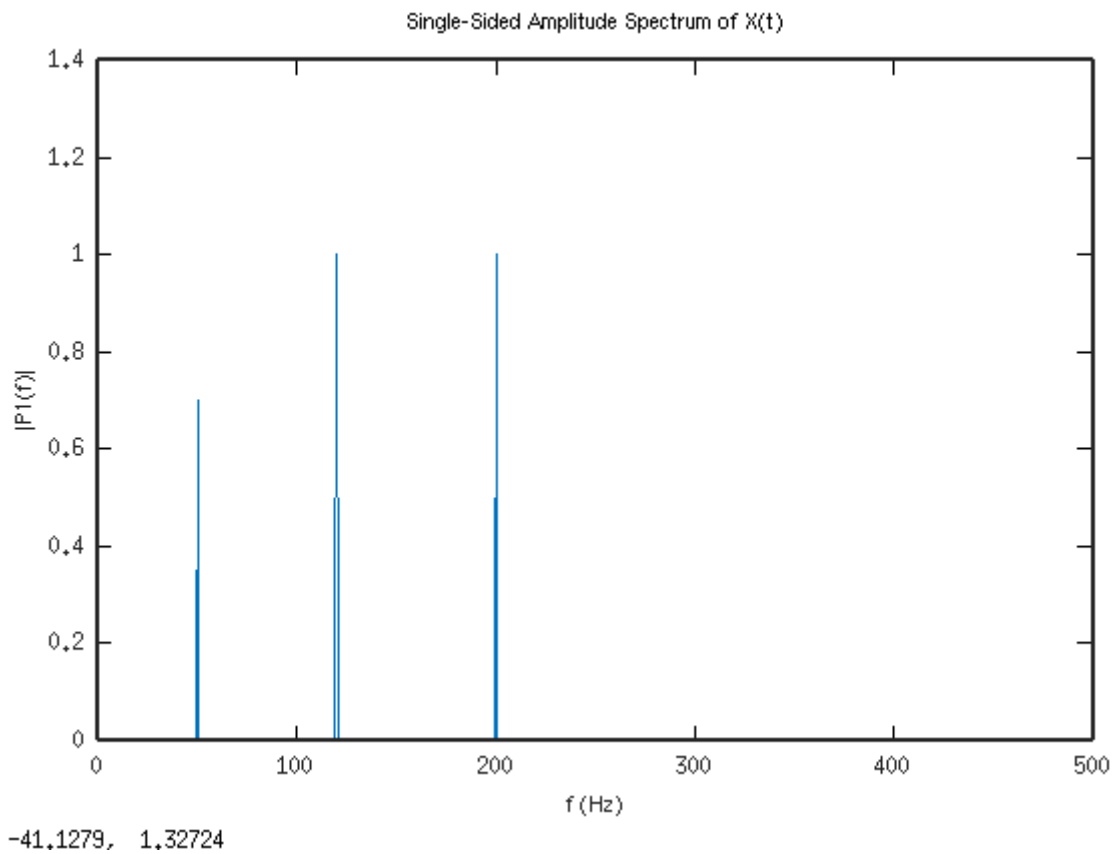
The signal below is combination of 3 frequencies. The 3 frequencies are 50, 120, and 200 Hz.

Figure 1



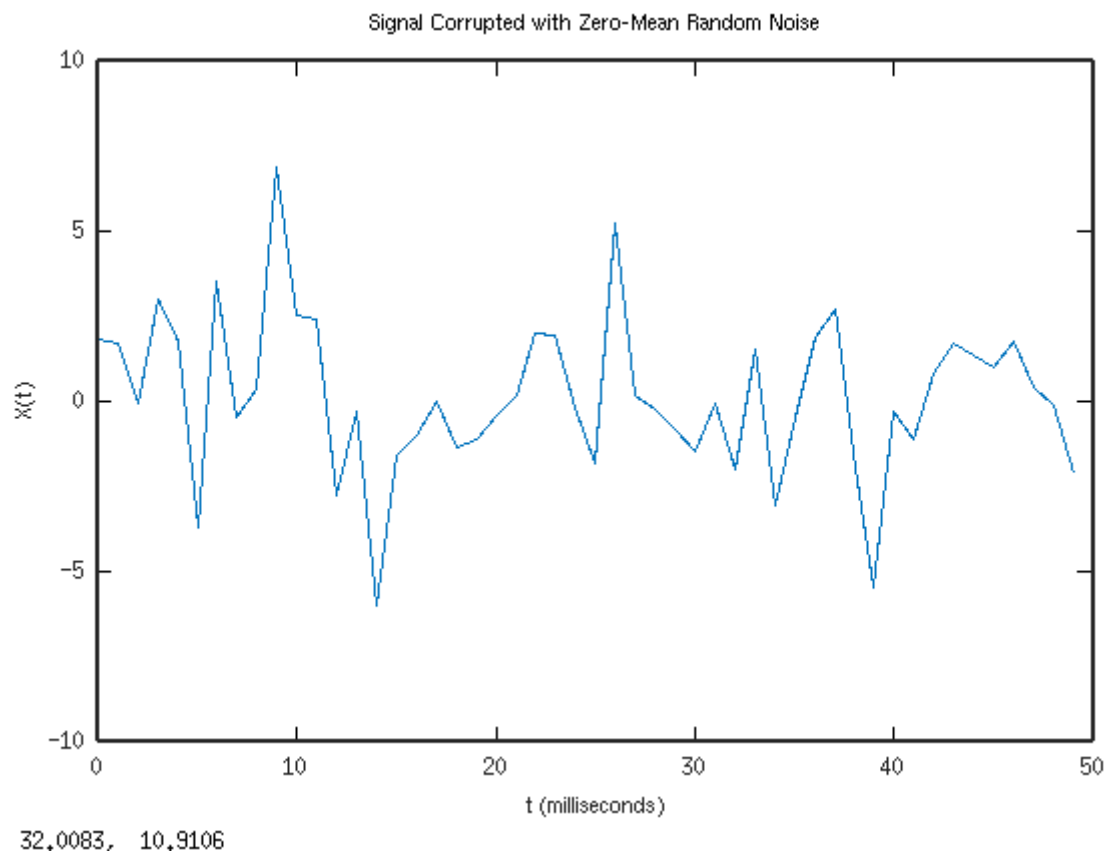
Taking the FFT demonstrates what frequencies make up the signal above.

Figure 2



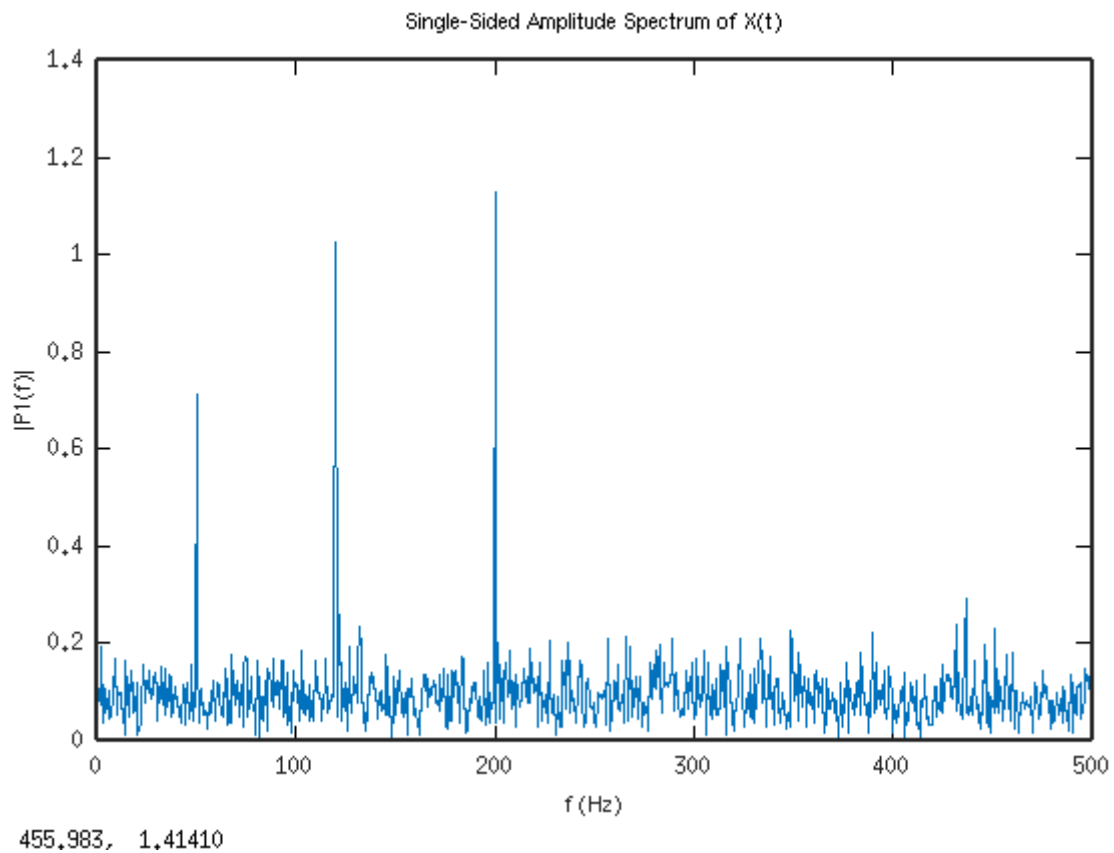
The signal below is combination of 3 frequencies with random noise. The 3 frequencies are 50, 120, and 200 Hz.

Figure 3



Taking the FFT demonstrates what frequencies make up the signal above.

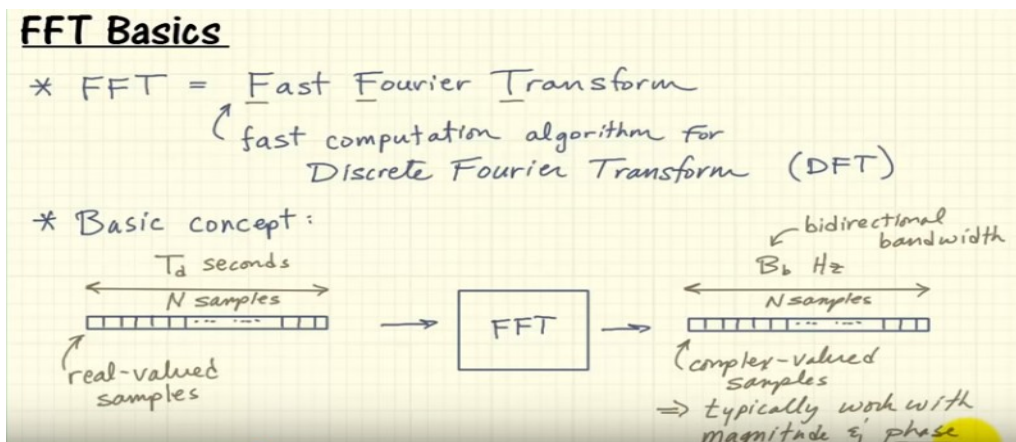
Figure 4



<https://www.youtube.com/watch?v=z7X6jgFnB6Y&feature=youtu.be>

fft.png

FFT basic concepts

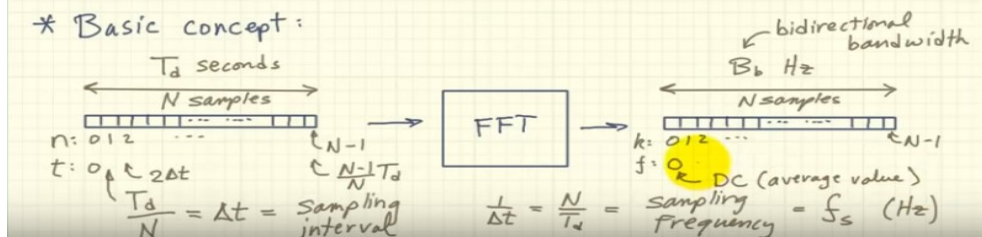


fft1.png

FFT Basics

* FFT = Fast Fourier Transform
 (fast computation algorithm for Discrete Fourier Transform (DFT))

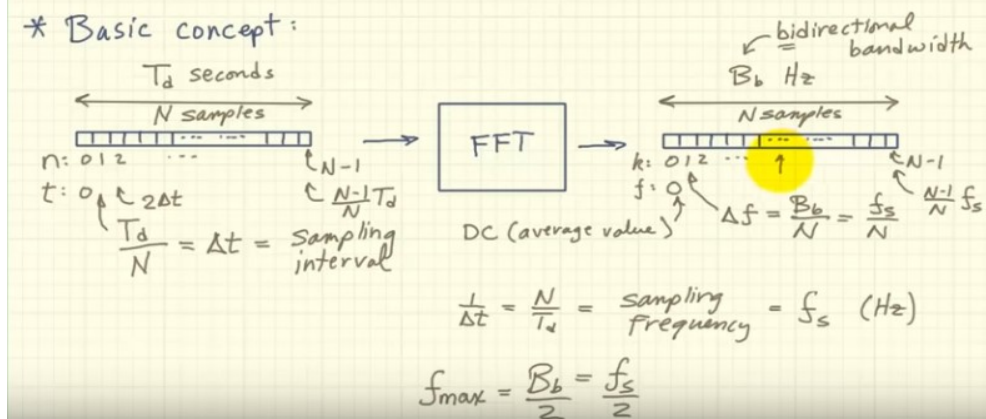
* Basic concept:



fft2.png

FFT Basics

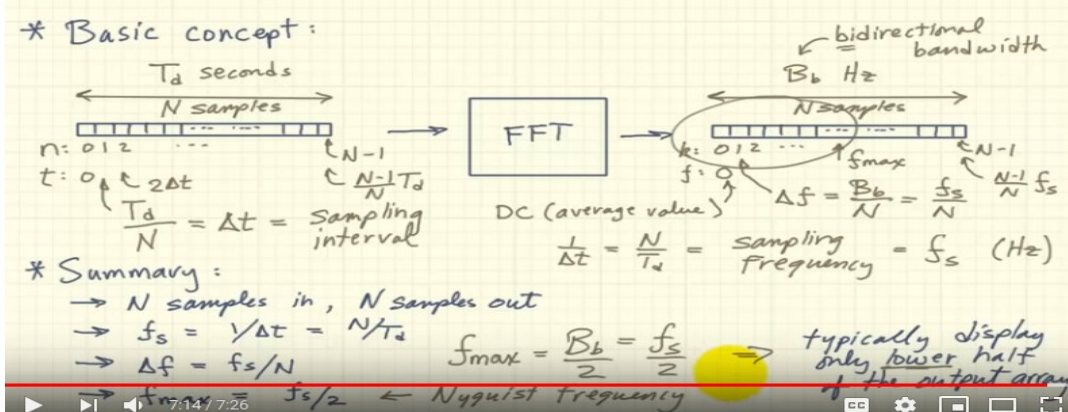
* Basic concept:



fft3.png

FFT Basics

* Basic concept:



Octave code that produce the plots above.

```
clear
close all
```

```
Fs = 1000; % Sampling frequency
```

```

T = 1/Fs;          % Sampling period
L = 1500;          % Length of signal
t = (0:L-1)*T;     % Time vector

%S = 0.7*sin(2*pi*50*t) + sin(2*pi*120*t);
S = 0.7*sin(2*pi*50*t) + sin(2*pi*120*t) + sin(2*pi*200*t);

```

```

X = S + 2*randn(size(t));

```

figure

```

plot(1000*t(1:50),X(1:50))
title('Signal Corrupted with Zero-Mean Random Noise')
xlabel('t (milliseconds)')
ylabel('X(t)')

```

```

Y = fft(X);

```

```

P2 = abs(Y/L);
P1 = P2(1:L/2+1);
P1(2:end-1) = 2*P1(2:end-1);

```

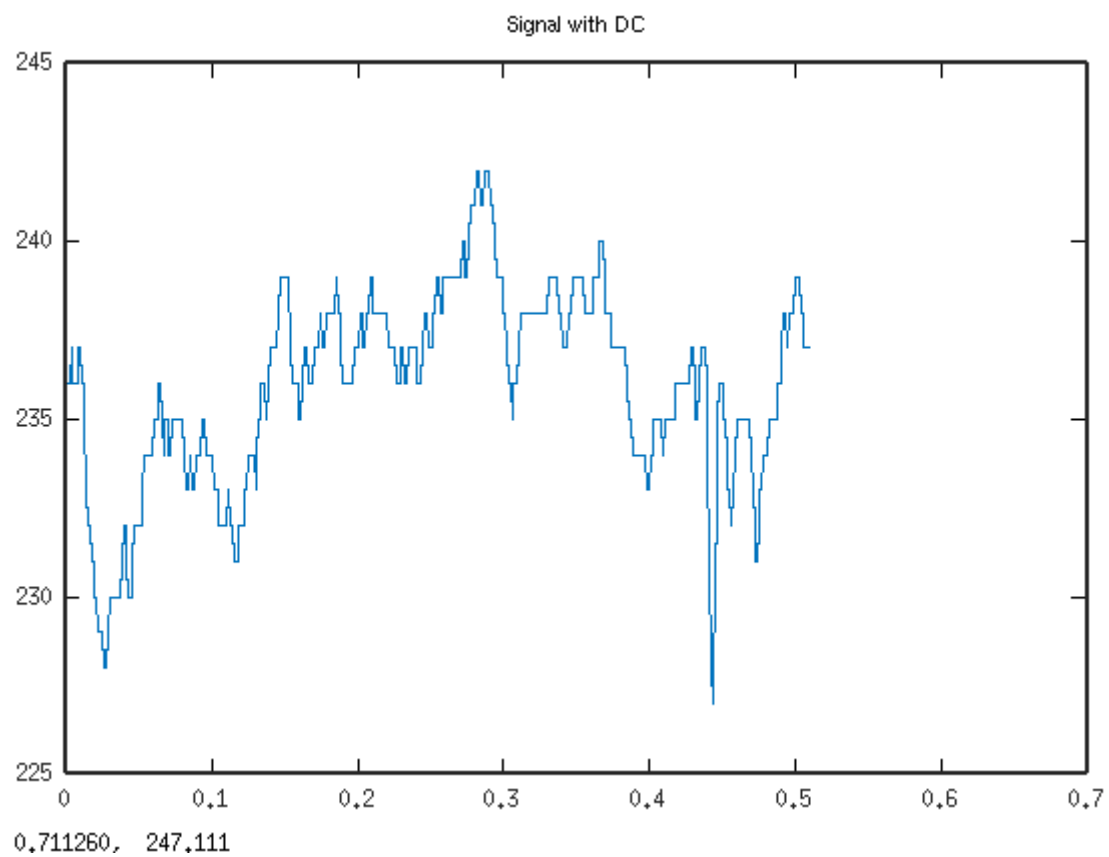
figure

```

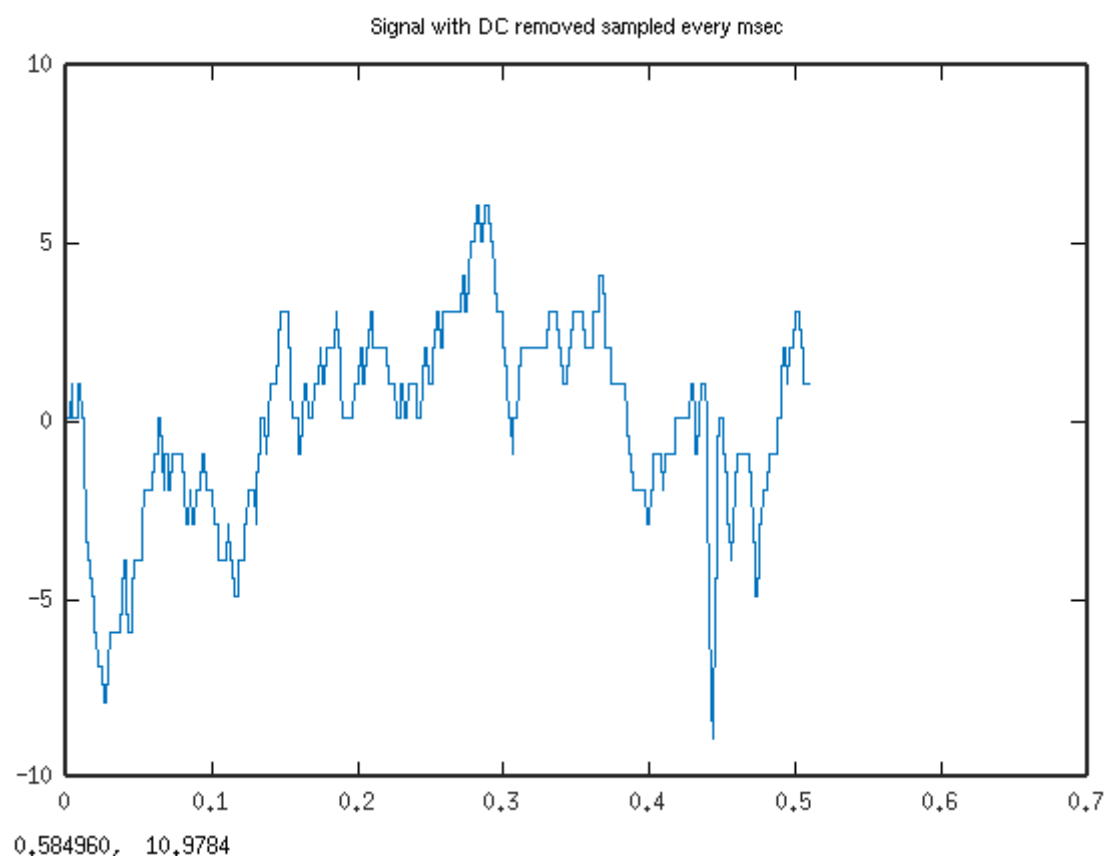
f = Fs*(0:(L/2))/L;
plot(f,P1)
title('Single-Sided Amplitude Spectrum of X(t)')
xlabel('f (Hz)')
ylabel('|P1(f)|')

```

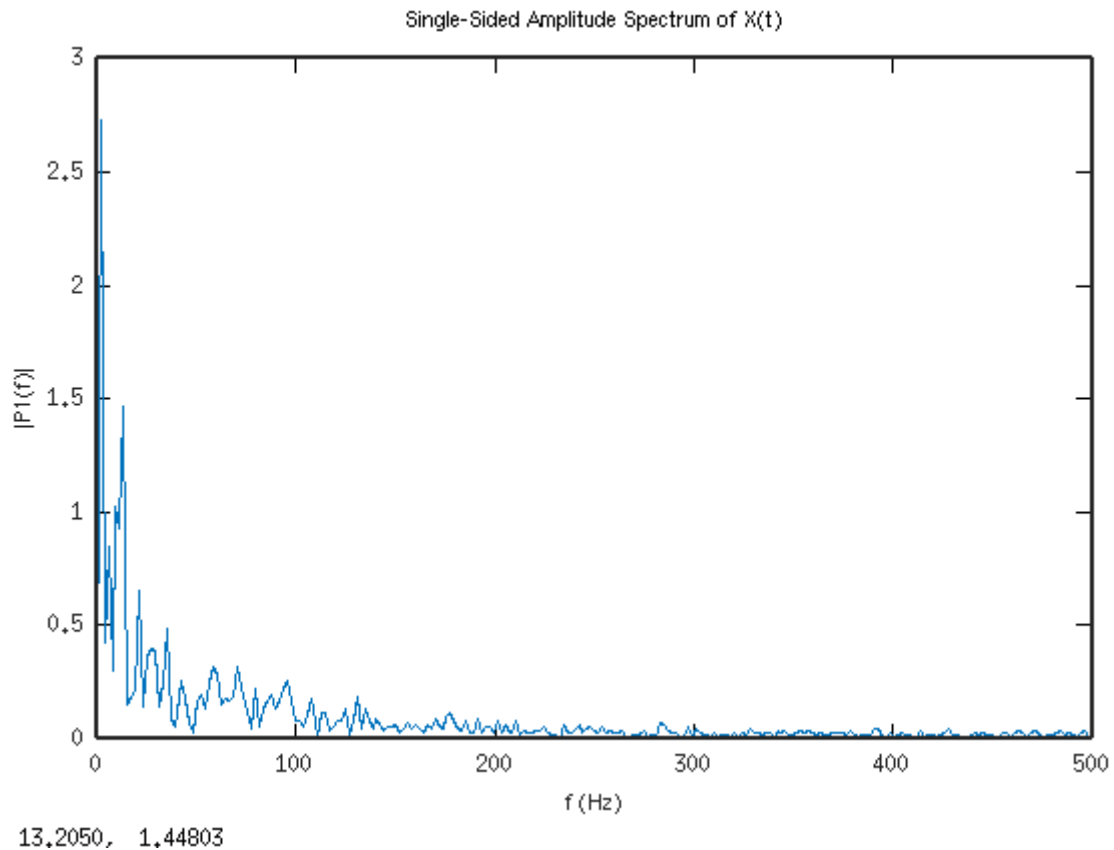
red.pgm 50th row sampled at 1KHz



red.pgm 50th row sampled at 1KHz with DC removed.
xbar = 235.90



FFT red.pgm 50th row.



```
clear
close all
%https://www.mathworks.com/matlabcentral/answers/1828-remove-dc-component-from-ee-
signals
Fs = 1000;      % Sampling frequency
T = 1/Fs;       % Sampling period
L = 512;        % Length of signal
t = (0:L-1)*T;  % Time vector

A = imread('red.pgm');
figure
x = A(1:512,50);
xbar = mean(x)

plot(t,x)

title("Signal with DC")

f = fft(x);
f(1) = 0;
x_ac = real(ifft(f));
[x_ac, x - mean(x)];

figure
plot(t,x_ac)
```

```
title("Signal with DC removed sampled every msec")
```

```
Ys = fft(x_ac);
```

```
P2 = abs(Ys/L);
```

```
P1 = P2(1:L/2+1);
```

```
P1(2:end-1) = 2*P1(2:end-1);
```

```
figure
```

```
f = Fs*(0:(L/2))/L;
```

```
plot(f,P1)
```

```
title('Single-Sided Amplitude Spectrum of X(t)')
```

```
xlabel('f (Hz)')
```

```
ylabel('|P1(f)|')
```