ADDITIONAL EXPERIMENTS

1. POWER SPECTRAL DENSITY ESTIMATION

AIM:

To calculate the power spectral density of a signal and plot the power distribution of the signal versus frequency graph

APPARATUS:

PC with MATLAB

THEORY:

The discrete Fourier transform (DFT) maps a finite number of discrete time-domain samples to the same number of discrete Fourier-domain samples. Being practical to compute, it is the primary transform applied to real-world sampled data in digital signal processing. The DFT has special relationships with the discrete-time Fourier transform and the continuous-time Fourier transform that let it be used as a practical approximation of them through truncation and windowing of an infinite-length signal. Different window functions make various tradeoffs in the spectral distortions and artifacts introduced by DFT-based spectrum analysis.
The DFT transforms *N* samples of a discrete-time signal to the same number of discrete frequency samples, and is defined as

$$X(k) = \sum_{n=0}^{N-1} x(n) e^{-\frac{i2\pi nk}{N}}$$

The DFT is invertible by the inverse discrete Fourier transform (IDFT):

$$x(n) = \frac{1}{N} \sum_{k=0}^{N-1} X(k) e^{i\frac{2\pi nk}{N}}$$

The DFT and IDFT are a self-contained, one-to-one transform pair for a length-*N* discrete-time signal. The DFT is notmerely **a**n approximation to the DTFT. However, the DFT is very often used as a practical approximation to the DTFT.

PROCEDURE:-

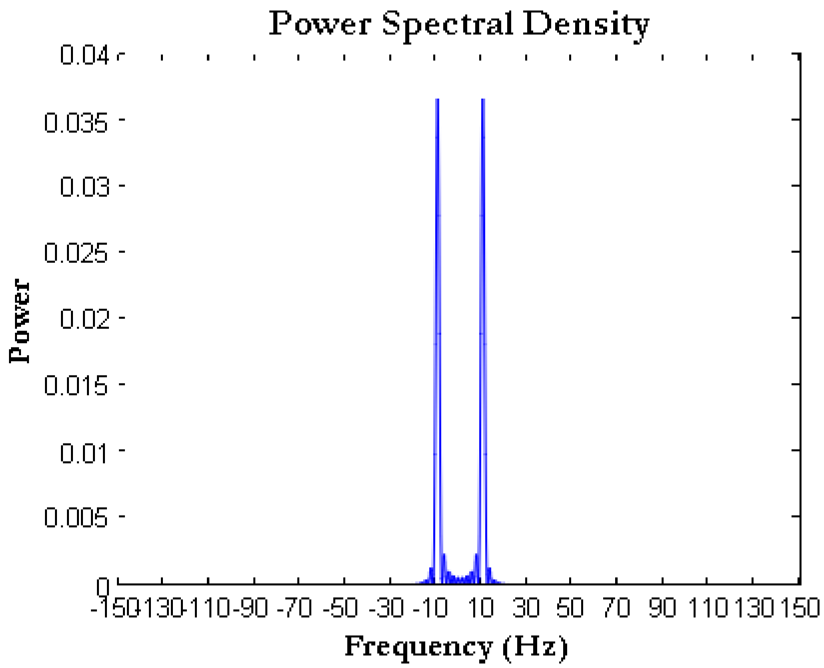
- Open MATLAB
- Open new M-file
- Type the program
- Save in current directory
- Compile and Run the program
- For the output see command window\ Figure window

PROGRAM:

```
clc;
```

```
closeall;
clearall;
Fs = 1000;
t = 0:1/Fs:1-1/Fs;
x = cos(2*pi*100*t) + randn(size(t));
N = length(x);
xdft = fft(x);
xdft = xdft(1:N/2+1);
psdx = (1/(Fs*N)) * abs(xdft).^2;
psdx(2:end-1) = 2*psdx(2:end-1);
freq = 0:Fs/length(x):Fs/2;
plot(freq,10*log10(psdx))
gridon
title('Power Spectral Density')
xlabel('Frequency (Hz)')
ylabel('Power (dB)')
```

OUTPUT:



RESULT:

DFT Spectral analysis on a continuous time signal was performed and the Power density spectral graph with respect to frequency was plotted