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194107 ECE-3A

Frequency Shift keying

Communication System LAB

Aim - To develop a MATLAB program for Frequency Shift keying of an input message signal

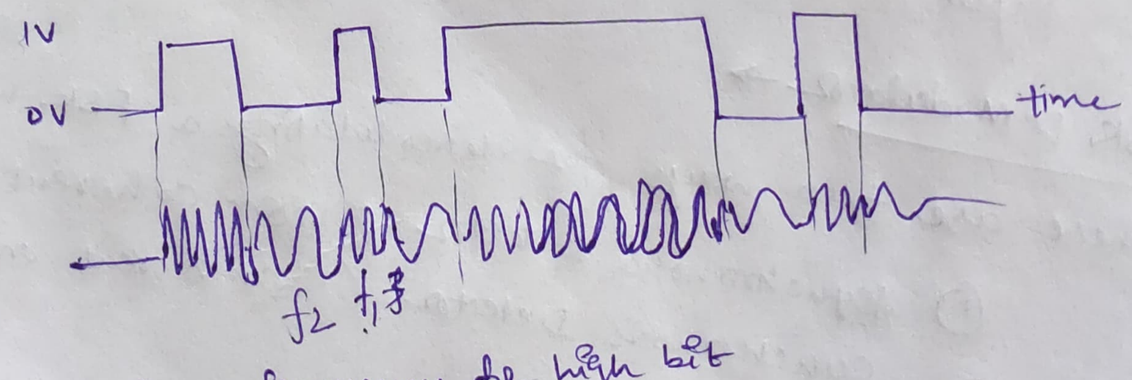
Software - MATLAB R2021b.

Theory - FSK is a digital modulation technique in which the frequency of carrier signal varies according to the digital signal changes. FSK is a scheme of frequency modulation.

The output of FSK modulated wave is high in freq. for a binary high input and is low in frequency for a binary low input.

binary 1s and 0s are called as mark & space frequencies.

Input binary seq:-

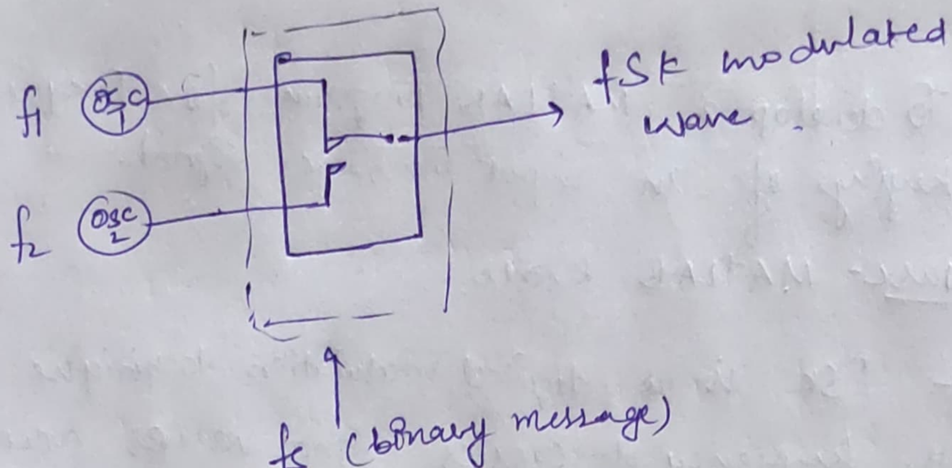


$f_1 \rightarrow$ frequency for high bit

$f_2 \rightarrow$ frequency for low bit.

FSK Modulator-

The FSK Modulator block diagram comprises of two oscillator with a clock and the input binary sequence.



$f_s \simeq f_2$ bit rate $f_s << f_1$.

two oscillator, producing a higher and a lower frequency signal are connected to a switch along with an internal clock to avoid the abrupt phase discontinuities of the output waveform during the transmission of the message, a clock is applied to both the oscillator internally the binary input sequence is applied to the transmitter so as choose the frequency according to the binary input.

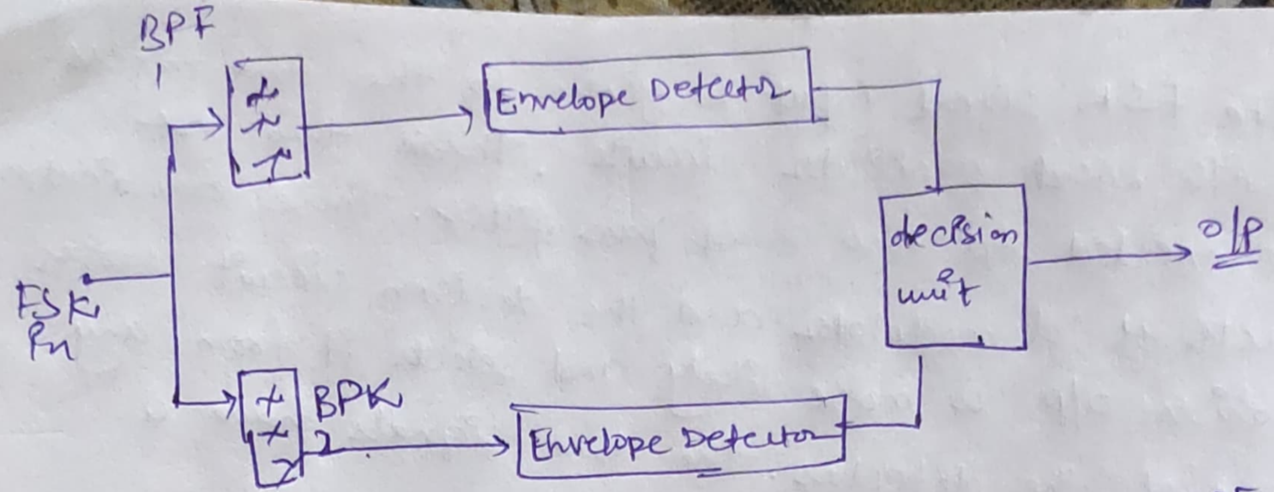
FSK Demodulator →

there are two ways for demodulating a FSK wave.

① Asynchronous Detector (non-coherent one)

② Synchronous Detector. (co-herent one).

Asynchronous Detector- It consist of two band pass filters two envelope detector, and a decision unit.

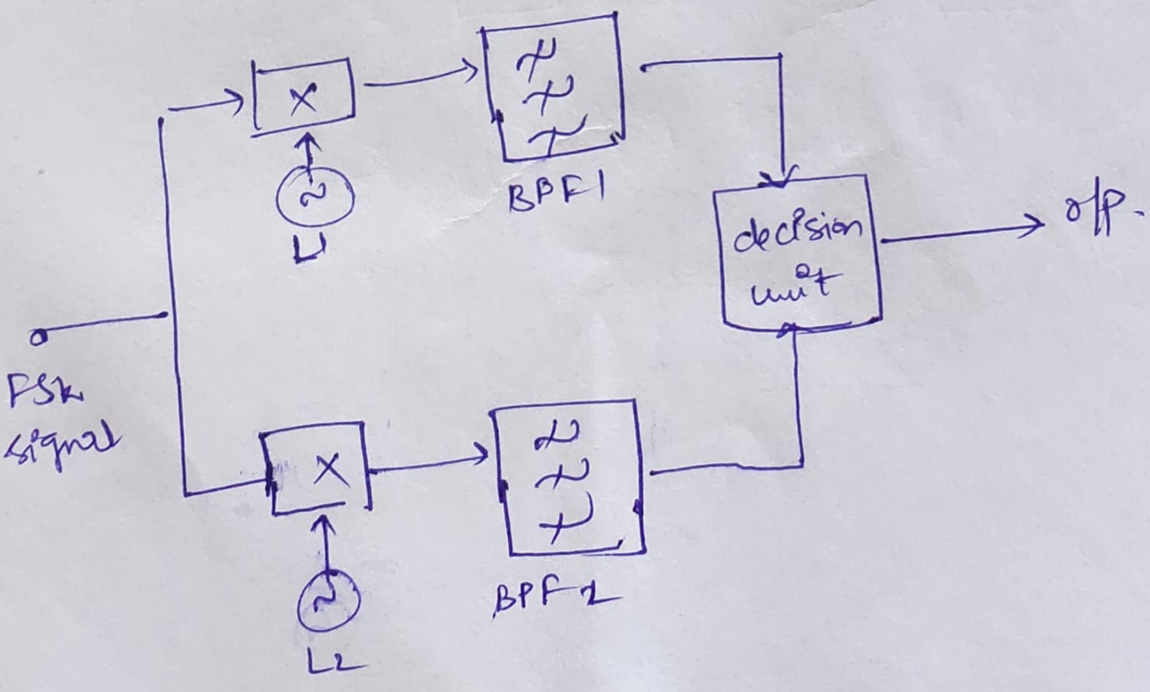


FSK signal is passed through two band pass filter BPFs. them into Space & Mark frequencies. The output from two BPFs looks like ASK signal, which is given to the envelope detector. The signal in each envelope detector is modulated asynchronously.

The decision circuit choose which output is more likely and selects it from any one of the envelope detectors. It also re-shapes the wave forms to a rectangular one.

Synchronous FSK Detector →

It consist of two mixer with local oscillator circuits, two band pass filter and a decision circuit.



The FSK signal input is given to the two mixers with local oscillator circuits. These two are connected to two band pass filter. These combinations acts as demodulator and the decision circuit chooses which o/p is more likely and selects it from any one of the detectors. The two signals have a minimum frequency seperation

→ For both the demodulators, the band width of each of them depends on their bit rate. This synchronous demodulator is a bit complex than asynchronous type demodulators.

Results →

The MATLAB program for frequency shift keying of a digital signal was developed.
Plots were observed for ~~de~~ modulated signal and its power spectral density.

```matlab
clear;
clc;

% Take=ing input Bit Stream
b = input('Enter the Bit stream \n '); %b = [0 1 0 1 1 1 0];
n = length(b);
t = 0:.01:n;
x = 1:1:(n+1)*100;

for i = 1:n
    if (b(i) == 0)
        b_p(i) = -1;
    else
        b_p(i) = 1;
    end
    for j = i:.1:i+1
       bw(x(i*100:(i+1)*100)) = b_p(i);
    end
end

bw = bw(100:end);
wo = 2*(2*pi*t);
W = 1*(2*pi*t);

% For 1's in Input Bit Stream
sinHt = sin(wo+W);

% For 1's in Input Bit Stream
sinLt = sin(wo-W);

st = sin(wo+(bw).*W);

subplot(4,1,1)
plot(t,bw)
xlabel('Time(sec)');
ylabel('Amplitude(volt)');
title('Input Binary Data');
grid on ; axis([0 n -2 +2])

subplot(4,1,2)
plot(t,sinHt)
xlabel('Time(sec)');
ylabel('Frequency of Ones');
title('Carrier Frequency F1 for "1"');
grid on ; axis([0 n -2 +2])

subplot(4,1,3)
plot(t,sinLt)
xlabel('Time(sec)');
ylabel('Frequency of Zeros');
title('Carrier Frequency F2 for "0"');
grid on ; axis([0 n -2 +2])

subplot(4,1,4)
```

```
plot(t,st)
xlabel('Time(sec)');
ylabel('Amplitude(volt)');
title('FSK Modualated Signal');
grid on ; axis([0 n -2 +2])

Fs=1;
figure %pburg(st,10)
periodogram(st)
```

```
Enter the Bit stream
 [0 1 0 1 1 1 0]
fx >>
```

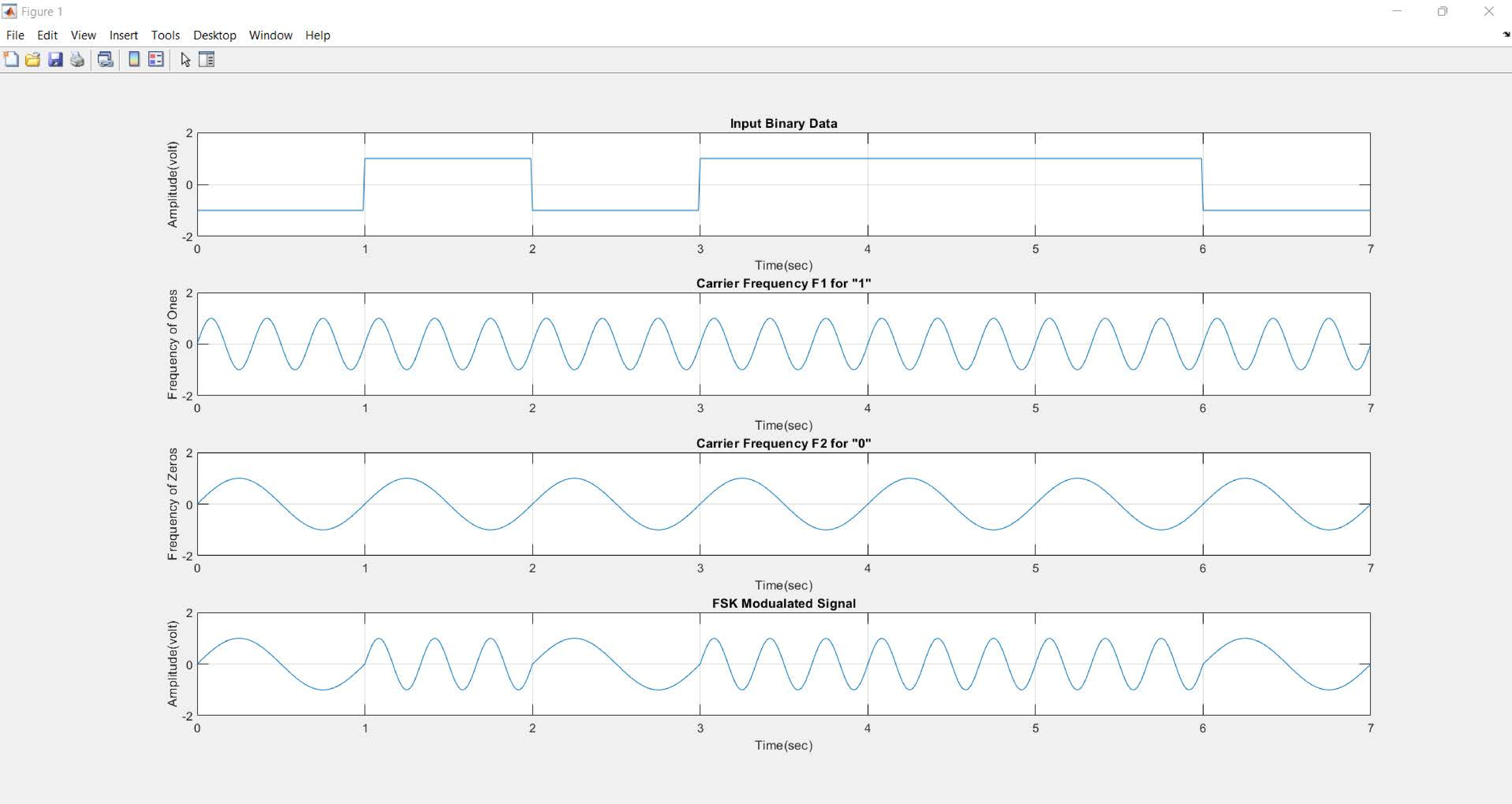


Figure 1
File Edit View Insert Tools Desktop Window Help
Input Binary Data
Amplitude(volt)
Time(sec)
Carrier Frequency F1 for "1"
Frequency of Ones
Time(sec)
Carrier Frequency F2 for "0"
Frequency of Zeros
Time(sec)
FSK Modualated Signal
Amplitude(volt)
Time(sec)

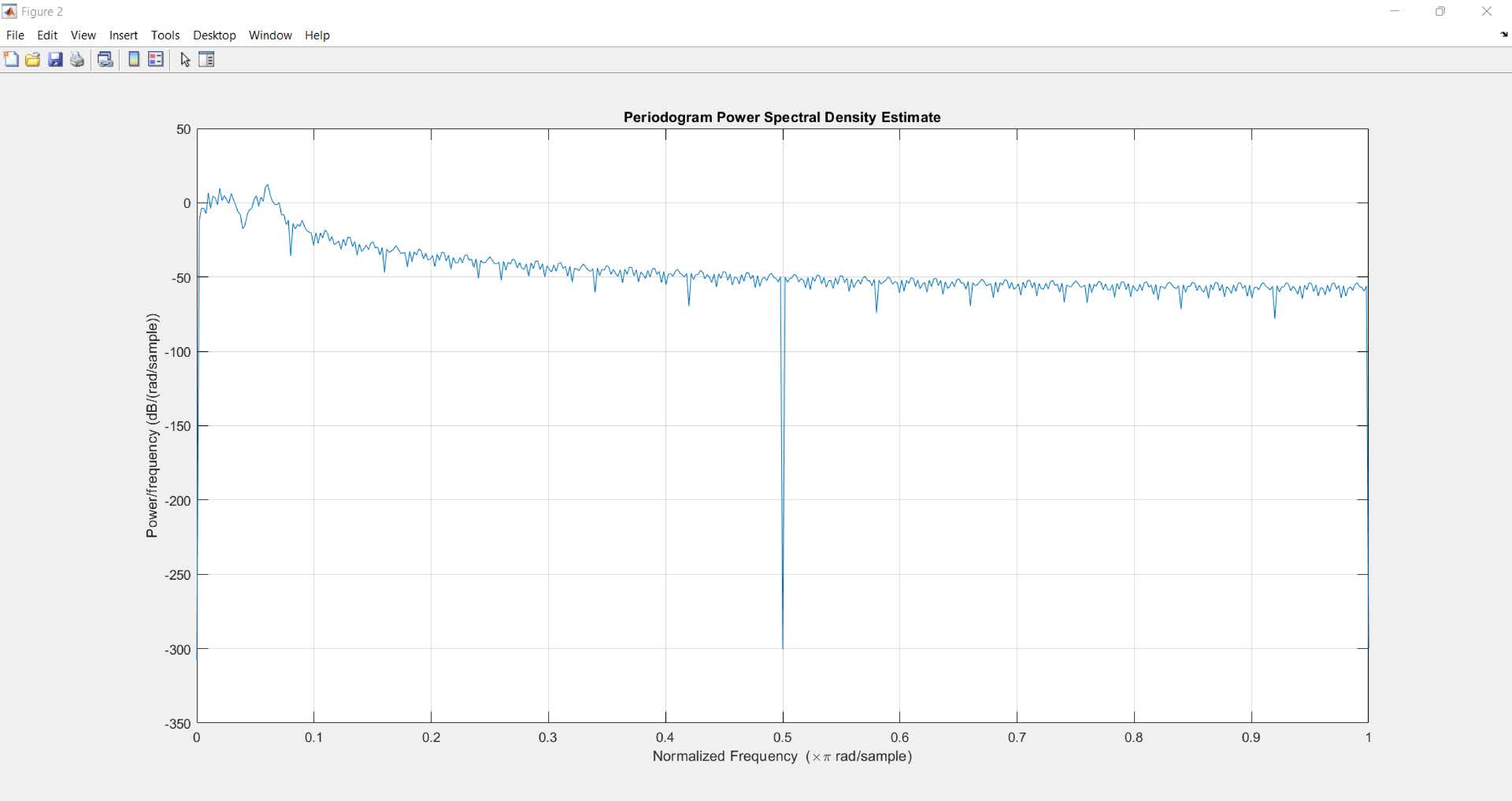


Figure 2
File Edit View Insert Tools Desktop Window Help
Periodogram Power Spectral Density Estimate
50
0
-50
-100
-150
-200
-250
-300
-350
Power/frequency (dB/(rad/sample))
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Normalized Frequency (×π rad/sample)