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| **العربية** | Communication and Electronics Department Analog Communication - EEC 381  Fall 2023 - 2024 |

REPORT

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| **Name** | **ID** |
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|  |  |
| **Section:** | 8 |
|  |  |
| **Department:** | **Communication and Electronics** |

**Experiment One: Double Sided Band Modulation: -**

**Signal in frequency domain:**

Figure : start function responsible for analyzes the input audio file and computes its spectrum.

A screenshot of a computer program

Description automatically generated

Figure original spectrum of the signal

A screen shot of a computer screen

Description automatically generated

A screenshot of a computer

Description automatically generated**Filtered Signal:**

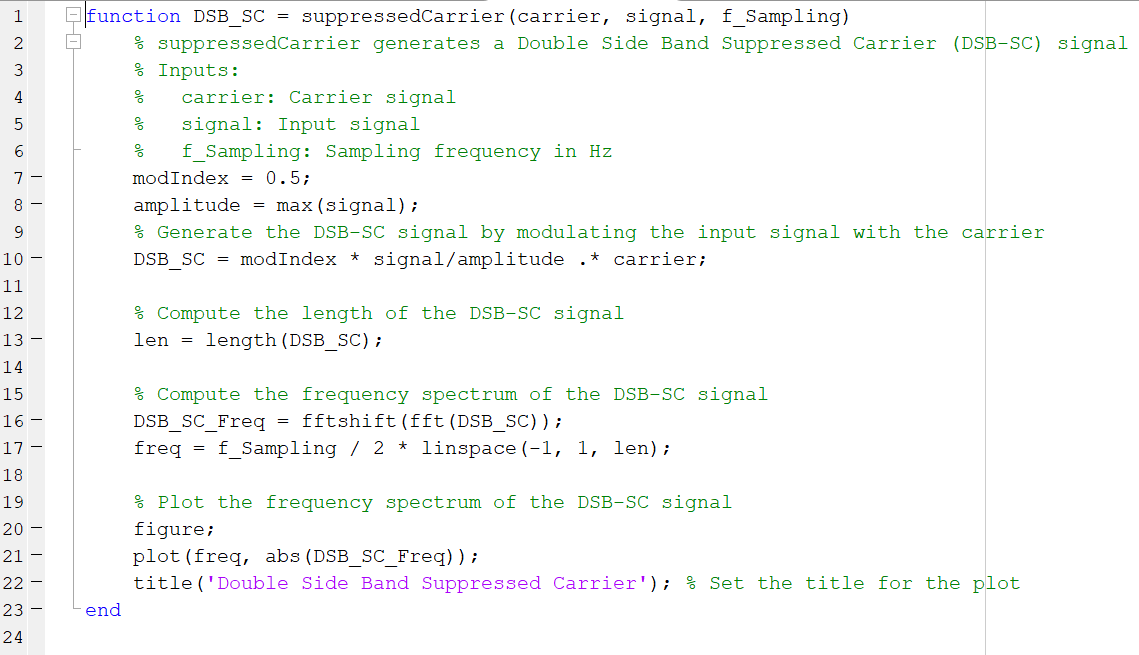
A screen shot of a computer screen

Description automatically generated

A screen shot of a graph

Description automatically generated

**Double Sideband Suppressed Carrier:**



A screenshot of a computer

Description automatically generated

**Double Sideband Transmitted Carrier:**

A screenshot of a computer program

Description automatically generated

A screenshot of a computer

Description automatically generated

* **Envelop Detection: -**

A screenshot of a computer

Description automatically generated

-In this point our observations are while playing the sound in case of DSB-SC the sound wasn’t clear and good enough to hear the whole message as there is a lot of attenuation, distortion and phase reversal, in contrast to DSB-TC case the sound was excellent and we can hear the message clearly without distortion or attenuation or phase reversal because of the modulation index which is less than 1, so in summary the envelop detector receiver is much better with DSB-TC but in cases where modulation index is less than (Under modulation) or equal (Critical modulation) 1 other than these cases the envelop detector will be bad choice to receive a DSB signal and coherent detector will be better.

1. **Envelop Detection of Double Sideband Suppressed Carrier:**

A screen shot of a graph

Description automatically generated

1. **Envelop Detection of Double Sideband Transmitted Carrier:**

A screen shot of a graph

Description automatically generated

* **Coherent Detection:**

A screenshot of a computer program

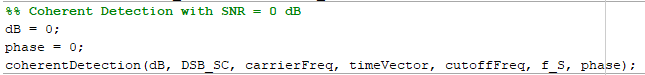
Description automatically generated

A screenshot of a computer code

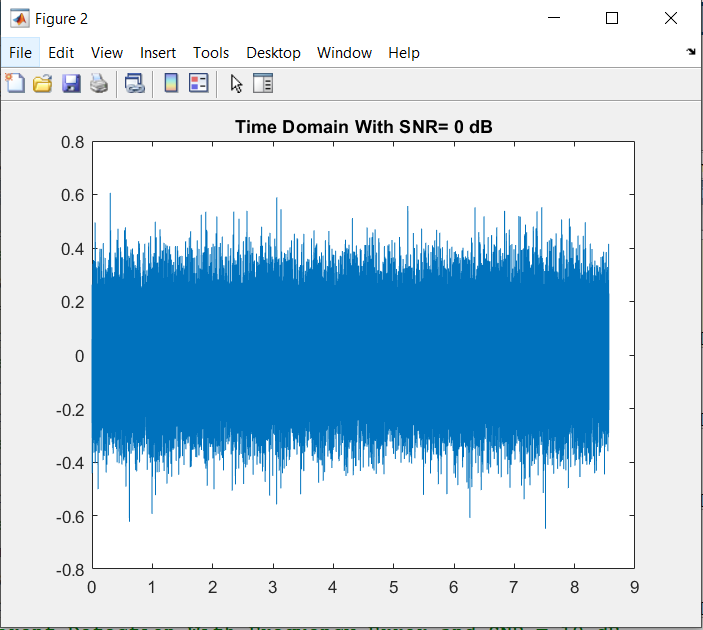
Description automatically generated

A screen shot of a computer

Description automatically generated

1. **SNR = 0:**

**Signal in Time Domain:**



**Signal in Frequency Domain:**

A screen shot of a graph

Description automatically generated

1. **SNR = 10:**

**Signal in Time Domain:**

A screen shot of a computer

Description automatically generated

**Signal in Frequency Domain:**

A screen shot of a graph

Description automatically generated

1. **SNR=30:**

**Signal in Time Domain:**

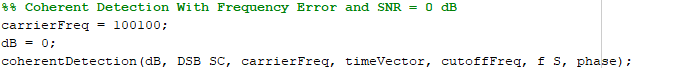
A screen shot of a computer

Description automatically generated

**Signal in Frequency Domain:**

A screen shot of a graph

Description automatically generated

1. **Frequency Shift and SNR=0:**

**Signal in Time Domain:**

A screen shot of a computer screen

Description automatically generated

**Signal in Frequency Domain:** A screenshot of a computer

Description automatically generated

1. **Frequency Shift and SNR=10:**

**Signal in Time Domain:**

A screen shot of a computer

Description automatically generated

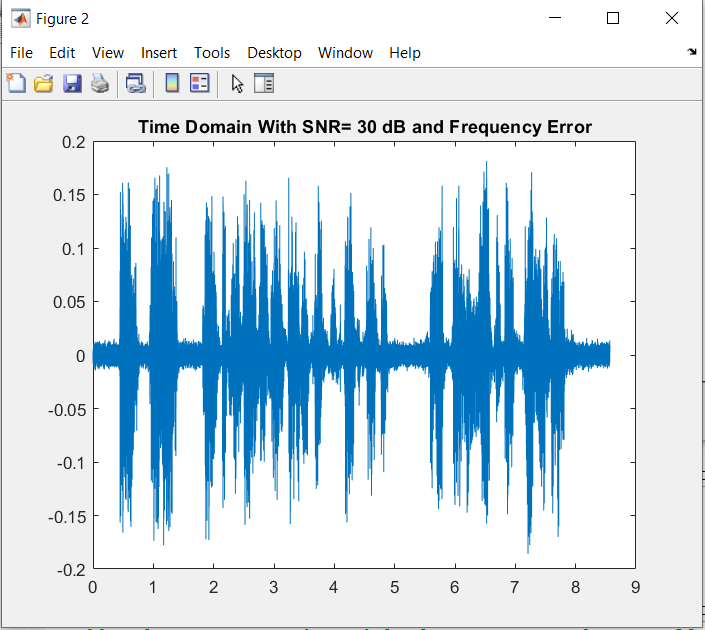
**Signal in Frequency Domain:**

A screen shot of a graph

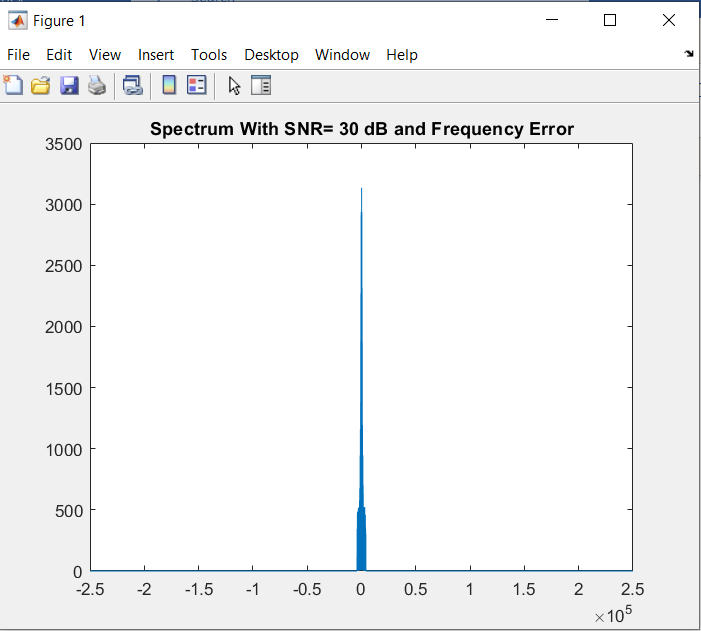
Description automatically generated

1. **Frequency Shift and SNR=30:**

**Signal in Time Domain:**

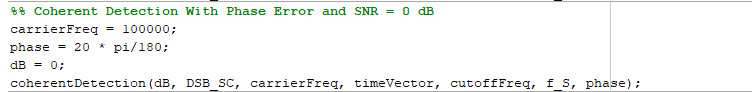


**Signal in Frequency Domain:**



-For proper detection with coherent detector it shouldn’t be any phase or frequency errors between the transmitter and the receiver so in our case we have here shift in frequency which leads to distortion in the received message and this phenomenon is called Beat effect.

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1. **Phase Error and SNR=0:**

**Signal in Time Domain:**

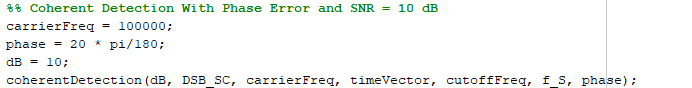
A screen shot of a computer screen

Description automatically generated

**Signal in Frequency Domain:**

A screen shot of a graph

Description automatically generated

1. **Phase Error and SNR=10:**

**Signal in Time Domain:**

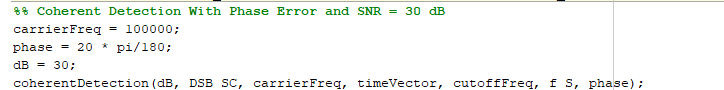
A screen shot of a computer screen

Description automatically generated

**Signal in Frequency Domain:**

A screen shot of a graph

Description automatically generated

1. **Phase Error and SNR=30:**

**Signal in Time Domain:**

A screen shot of a computer screen

Description automatically generated

**Signal in Frequency Domain:**

A screen shot of a graph

Description automatically generated

**Experiment Two: Single Side Band Modulation: -**

A screenshot of a computer program

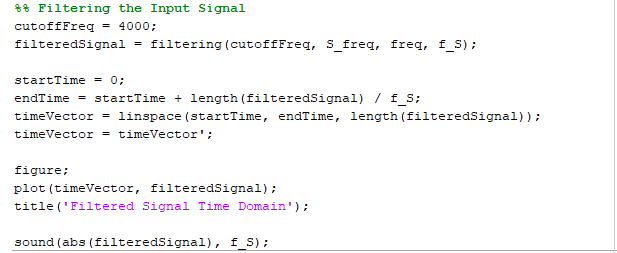
Description automatically generated

**Signal in frequency domain:**

A screen shot of a computer screen

Description automatically generated

**Filtered Signal:**

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A screenshot of a computer

Description automatically generated

**Filtered Signal in frequency domain:**

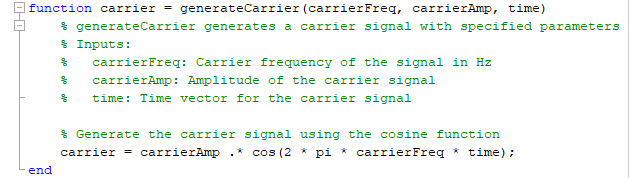
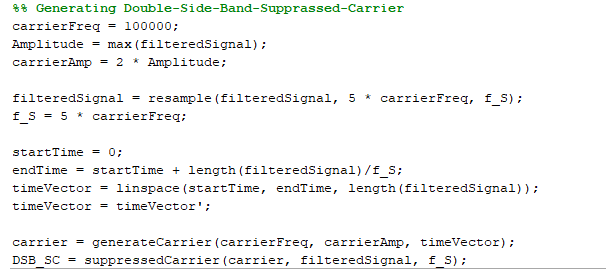
A screen shot of a graph

Description automatically generated

**Filtered Signal in Time Domain:**

A screen shot of a computer screen

Description automatically generated

**Double Sideband Suppressed Carrier:**

A screenshot of a computer program

Description automatically generated

A screenshot of a computer

Description automatically generated

**Single Sided Band (LSB only):**



A screenshot of a computer program

Description automatically generated

A white background with colorful text

Description automatically generated

A screen shot of a computer

Description automatically generated

**Demodulated signal spectrum:**

A screenshot of a computer program

Description automatically generated

A screenshot of a computer code

Description automatically generated

A screen shot of a computer

Description automatically generated**Demodulated signal in time domain:**

A screen shot of a computer

Description automatically generated

**Obtaining SSB (LSB) Using a practical 4th order Butterworth filter:**

A screenshot of a computer program

Description automatically generated

A graph of a number

Description automatically generated

**Demodulated signal spectrum Using a practical 4th order Butterworth filter:**

A screenshot of a computer program

Description automatically generated

A screen shot of a computer code

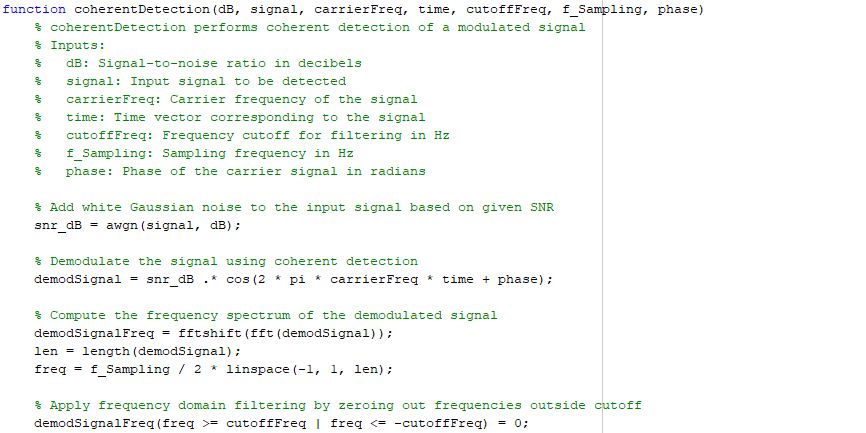
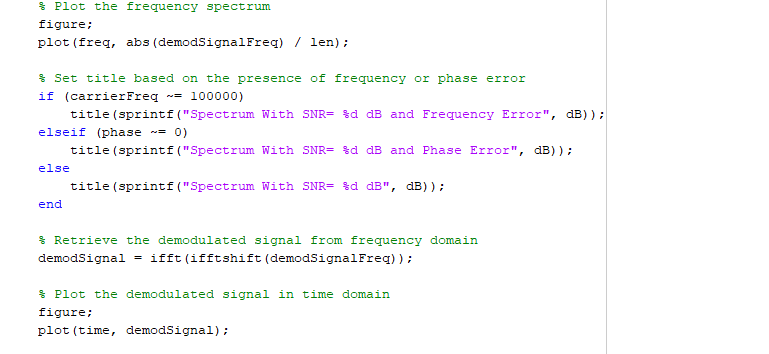
Description automatically generated

A graph of a signal

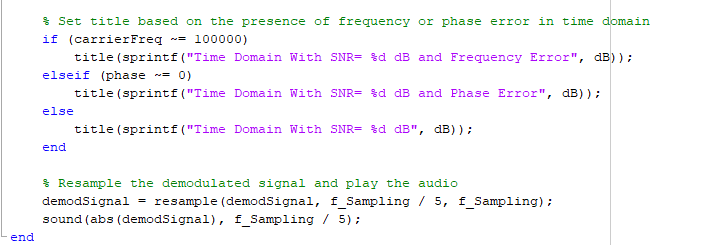
Description automatically generated

A screen shot of a computer

Description automatically generated**Demodulated signal spectrum Using a practical 4th order Butterworth filter in time domain:**

* **Coherent Detection:**



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1. **A black text on a white background

   Description automatically generatedSNR = 0:**

**Signal in Time Domain:**

A screen shot of a computer screen

Description automatically generated

**Signal in Frequency Domain:**

A screen shot of a graph

Description automatically generated

1. **SNR = 10:**

**Signal in Time Domain:**

A screen shot of a graph

Description automatically generated

**Signal in Frequency Domain:**

A screen shot of a graph

Description automatically generated

1. **SNR=30:**

**Signal in Time Domain:**

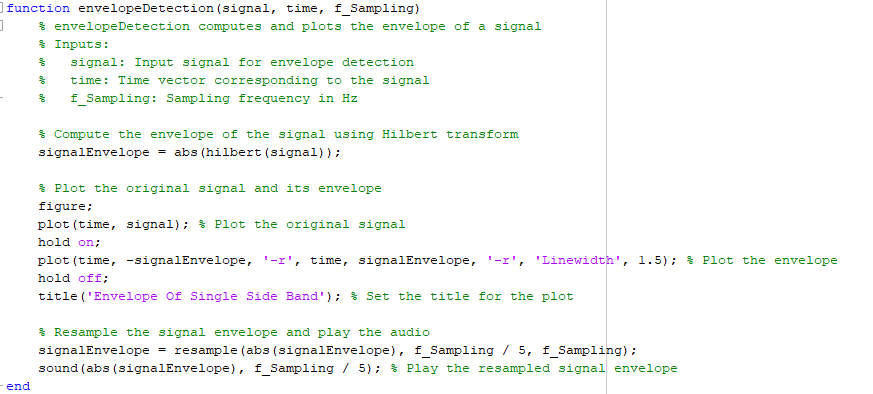
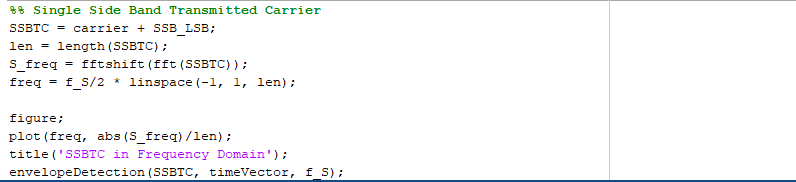
A screen shot of a computer screen

Description automatically generated

**Signal in Frequency Domain:**

A screen shot of a graph

Description automatically generated

**Single Sided Band Transmitted Carrier:**



**Demodulated signal using Envelop detection:**

A screenshot of a computer

Description automatically generated

A screen shot of a graph

Description automatically generated

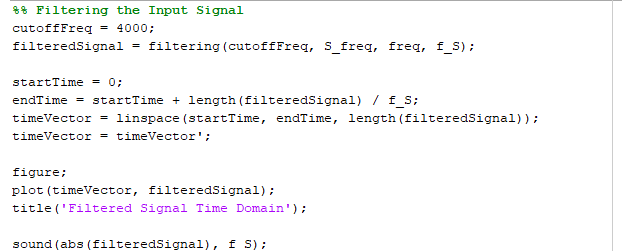
**Experiment Three: Frequency Modulation: -**

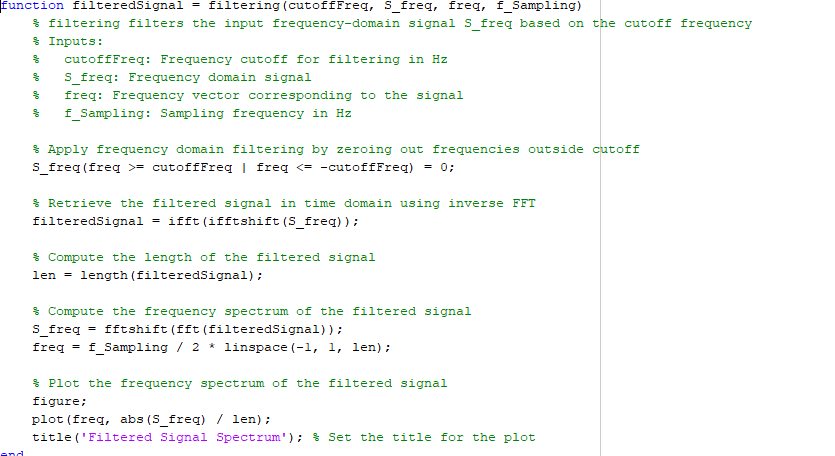
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A screen shot of a computer screen

Description automatically generated**Signal in frequency domain:**

**Filtered Signal:**

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A screen shot of a graph

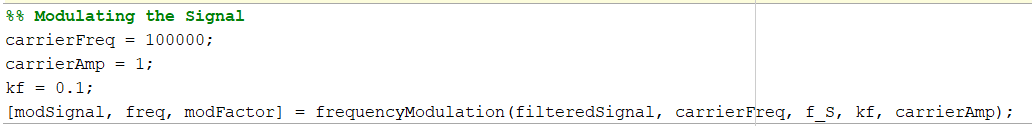
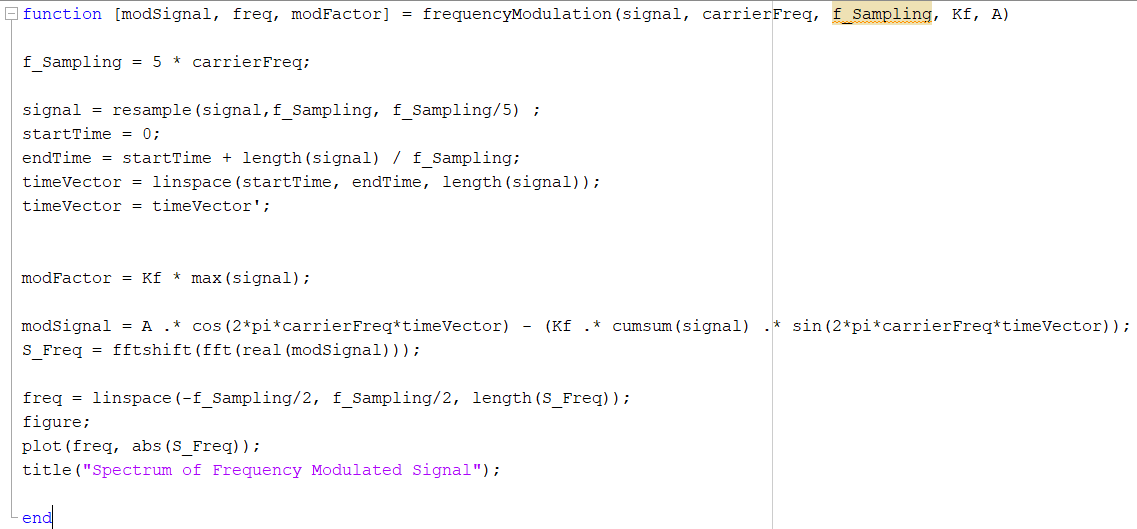
Description automatically generated

**Filtered Signal in Time Domain:**

A screen shot of a computer screen

Description automatically generated

**Modulated NBFM signal in Frequency Domain:**



A graph of a frequency

Description automatically generated

- We notice that the resulting spectrum shape is almost like DSB-TC with bandwidth equal .

- According to Carson’s rule:

So, the condition to achieve narrow band frequency modulation is to have a very frequency deviation which will lead to small frequency deviation ratio (<1) so that its value can be ignored compared to 1 which makes the bandwidth equal double the bandwidth of the message which is like DSB and specially DBS-TC as the carrier is also transmitted.

**Demodulated NBFM signal in Frequency Domain:**

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A screenshot of a computer program

Description automatically generated

**Demodulated NBFM signal in Frequency Domain**:

A graph of a signal

Description automatically generated

**Demodulated NBFM signal in Time Domain**

A blue sound wave graph

Description automatically generated