Communication Report

Dr. Micheal Melek

Names:

Khaled Sabry **Sec:1 BN: 19**

Mahmoud Youssry **Sec:2 BN: 24**

1)

In Am -->

We first set values of Fc and u as given to us then we load music clip as modulating signal , then we resample signal And calculate delta time steps, then we calculate carrier ,absolute min amplitude and get carrier amplitude from(absolute min amplitude/u) ,after that we perform amplitude modulation then enter a loop and add different noise and demodulate it by detecting envelope and calculate MSE then after we finish we resample the last the received demodulated signal frequency to the original frequency

In Fm -->

We first set values of Fc and B then we load music clip as modulating signal then we resample signal and then get max Frequency deviation from B*Fs then we calculate Kf And calculate delta time steps and get instantaneous phase deviation, after that we make fm signal fm = 3 cos(Wct+Kf a(t)) and Ac is 3 then we loop on different SNR values add noise , demodulate signal and calculate MSE at the end of each SNR then after we finish we resample the last the received demodulated signal frequency to the original frequency

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2) we selected sample rate in order to avoid overlapping and losing some information so we resampled the modulating signal to 3 * FC = 3* 100KHZ for the modulating signal.

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3)u =Am(absolute min amplitude of modulating signal)/Ac(carrier amplitude)

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4)It has to be more than 2 (F(max frequency deviation /B (bandwidth of the modulating signal) to become WBFM

>2B

5) As SNR increases the demodulated signal quality increases and noise decreases

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6) AS B decrease noise increase so we use WBFM even if it has higher bandwidth but it has more immunity to noise than NBFM

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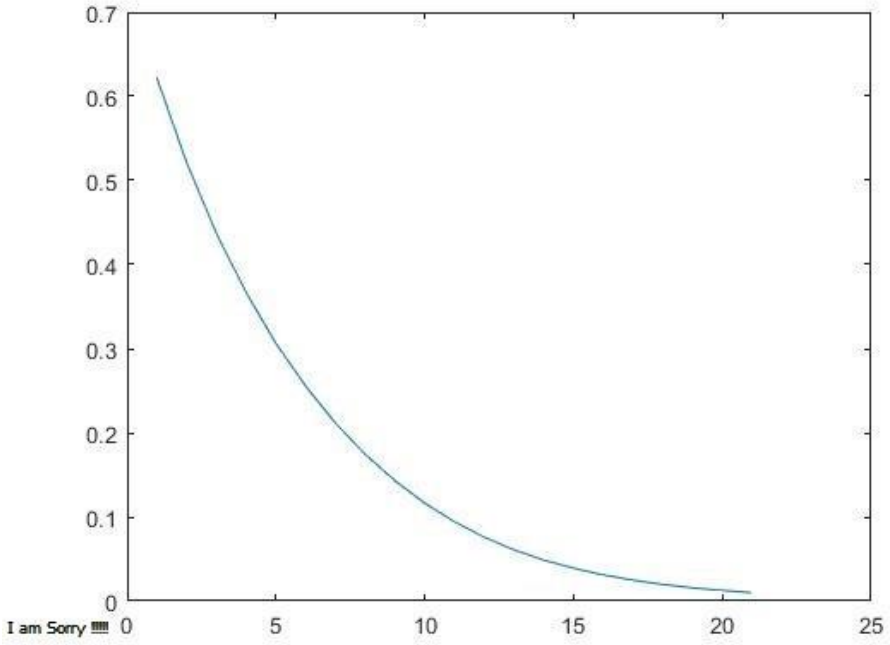
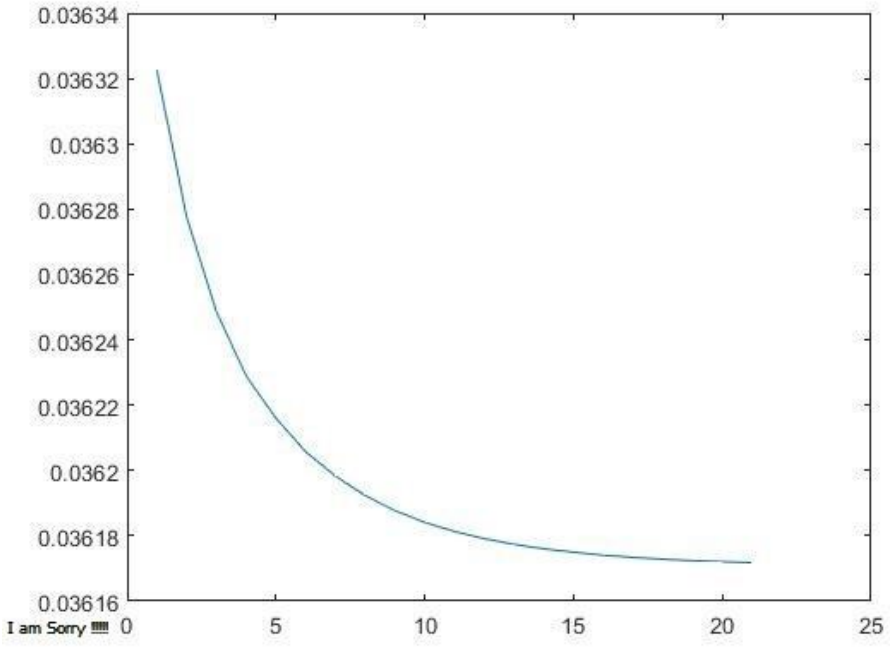
7)



AM



FM

As SNR increase The demodulation of signal is better in quality

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Code:

Am:

%givens

Fc = 100000;

u = 0.9;

%load music clip

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modulatingSignal = load('handel');
y = modulatingSignal.y;
O_Fs = modulatingSignal.Fs;
%resample
y = y(:,1);
Fs = 3*Fc;  % to avoid
y = resample(y, Fs, O_Fs);
delta = 1/Fs;
t = 0 : delta : (length(y)*delta)-delta;
%carrier, absolute minimum amplitude and Carrier Amplitude
carrier = cos(2*pi*Fc*t');
max_amplitude = abs(min(y));
Ac = max_amplitude / u;
%Amplitude Modulation
AM = (Ac + y).*carrier;
%Receive and Calc. MSE
MSE = [];
for i=0:20
   %add Noise
   noise = awgn(AM,i);
   %Demodulate
   yupper = envelope(noise);
   output = yupper - mean(yupper);
   %calc Mean Squard Error
```

```
    MSE = [MSE, immse(output, y)];
end

output = resample(output, O_Fs, Fs);
sound(output);
plot(MSE);
```

Fm:

```
%givens
Fc = 100000;
B = 5;
%load music clip
modulatingSignal=load('handel');
y = modulatingSignal.y;
O_Fs = modulatingSignal.Fs;
%resample and get Frequency Deviation
y = y(:,1);
Fs = 3*Fc;
y = resample(y, Fs, O_Fs);
freq_Deviation = B*(Fs);
%Get Kf
M = max(y);
Kf = 2*pi*O_Fs*B* (1/M);
%calc time
```

```
delta = 1/Fs;
t = 0 : delta : (length(y)*delta)-delta;
%make Fm Signal
cumsummatiom = cumsum(y)/Fs;
FM = 3 *cos(2*pi*Fc*t' + Kf*cumsummatiom); %3 is just a amplitude carrier
MSE = [];
for i=0:20
   noise = awgn(FM, i); %add Noise
   output = fmdemod(noise, Fc, Fs, freq_Deviation);  %Demodulate
   MSE = [MSE, immse(output, y)]; %calc Mean Squard Error
end

output = resample(output, O_Fs, Fs);
sound(output);
plot(MSE);
```