Task2

CODE:-

clc;

clear all;

close all;

env\_det=0;

sync\_det=1;

A=2;

message\_f=4000;

[y, fs\_voice ]=audioread('recording\_converted.mp3');

duration\_signal= length(y)/fs\_voice;

%sound(y(:,1),fs\_voice);

%keyboard;

%Play

for T = 1:duration\_signal/1 %%%% Duration 30 seconds with interval of 1 sec.

if T==0

disp('Transmission Started')

disp (T)

elseif (T==duration\_signal)

disp('Transmission Finished')

disp(T)

else

disp('Transmission in progress....')

disp(T)

end

fc=10000;

fs=8\*(10^6);

ts=1/fs;

L=fs\_voice;

t = (T-1)\*ts\*L:ts:L\*ts\*(T)-ts;

t=t';

m\_t=y(:,1);

if T==1

m\_t=m\_t(1:L);

else

m\_t=m\_t((T-1)\*L:T\*L-1);

end

am\_t=(m\_t) .\*cos(2.\*pi.\*fc.\*t);

N=length(m\_t);

m\_f=fft(m\_t)/N;

am\_f=fft(am\_t)/length(am\_t);

freqaxis=linspace(-fs/2,fs/2,N);

if env\_det==1

am\_dem\_t=hilbert(am\_t).\*exp(-1j\*2\*pi\*fc.\*t);

am\_dem\_t=abs(am\_dem\_t)-A;

end

if sync\_det==1

am\_dem\_t=am\_t.\*cos(2\*pi\*fc.\*t);

t1=-40:1/(4\*message\_f):40;

g\_t=2\*message\_f\*sinc(2\*message\_f\*t1);

am\_dem\_t=conv(am\_dem\_t,g\_t,'same');

am\_dem\_t=am\_dem\_t/1000;

end

am\_dem\_f=fft(am\_dem\_t)/(length(am\_dem\_t));

figure(1)

hold all;

subplot(3,2,1);

plot(t,m\_t);

xlabel('time(sec)');

ylabel('Amplitude');

title('Received signl TR');

grid on;

axis([0 inf -inf inf]);

hold on;

subplot(3,2,2);

plot(freqaxis,fftshift(abs(m\_f)));

xlabel('frequency(Hz)');

ylabel('Amplitude');

title('Received signl FR');

grid on;

axis([-inf inf -inf inf]);

hold on;

subplot(3,2,3);

plot(t,am\_t);

xlabel('time(sec)');

ylabel('Amplitude');

title('Modulated signl TR');

grid on;

axis([0 inf -inf inf]);

hold on;

subplot(3,2,4);

plot(freqaxis,fftshift(abs(am\_f)));

xlabel('frequency(Hz)');

ylabel('Amplitude');

title('Modulated signl FR');

grid on;

axis([-inf inf -inf inf]);

hold on;

subplot(3,2,5);

plot(t,am\_dem\_t);

xlabel('time(sec)');

ylabel('Amplitude');

title('Demodulated signl TR');

grid on;

axis([0 inf -inf inf]);

hold on;

subplot(3,2,6);

plot(freqaxis,fftshift(abs(am\_dem\_f)));

xlabel('frequency(Hz)');

ylabel('Amplitude');

title('Demodulated signl FR');

grid on;

axis([-inf inf -inf inf]);

pause(0.05);

end

Chart, diagram

Description automatically generated

Task 1

f = 100

fs = 100\*f

fc = 1000

duration = 30

t\_lpf = -5:1/fs:5

t\_lpf = t\_lpf'

lpf = 2000\*sinc(2000\*t\_lpf)

for i = 0:duration-1

t = -(i+1):1/fs:i+1

t = t'

U = randi(5)

m\_t = 2\*f\*U\*sinc(2\*U\*f\*(t-i))

n = length(m\_t)

fr = linspace(-fs/2,fs/2,n)

fr = fr'

m\_f = fftshift(abs(fft(m\_t)/n))

c\_s = 2\*cos(2\*pi\*fc\*t)

mod\_m\_t = m\_t.\*c\_s

mod\_m\_f = fftshift(abs(fft(mod\_m\_t)/n))

ssb = (conv(mod\_m\_t,lpf,'same'))

ssb\_f = fftshift(abs(fft(ssb)/n))

demod\_m\_t = ssb.\*(c\_s)

demod\_m\_f = fftshift(abs(fft(demod\_m\_t)/n))

demod = (conv(demod\_m\_t,lpf,'same'))

demod\_f = fftshift(abs(fft(demod)/n))

figure(1)

subplot(4,2,1)

plot(t,m\_t)

xlabel ('time(s)')

ylabel ('amplitude')

title ('Message signal')

grid on

hold all

subplot(4,2,2)

plot(fr,m\_f)

hold all

xlabel ('frequency(hz)')

ylabel ('amplitude')

title ('Message signal')

xlim([-2000 2000])

grid on

subplot(4,2,3)

plot(t,mod\_m\_t)

xlabel ('time(s)')

ylabel ('amplitude')

title ('Modulated signal')

grid on

hold all

subplot(4,2,4)

plot(fr,mod\_m\_f)

hold all

xlabel ('frequency(hz)')

ylabel ('amplitude')

title ('Modulated signal')

xlim([-2000 2000])

grid on

subplot(4,2,5)

plot(t,ssb)

xlabel ('time(s)')

ylabel ('amplitude')

title ('SSB')

grid on

hold all

subplot(4,2,6)

plot(fr,ssb\_f)

hold all

xlabel ('frequency(hz)')

ylabel ('amplitude')

title ('SSB')

xlim([-2000 2000])

grid on

subplot(4,2,7)

plot(t,demod)

xlabel ('time(s)')

ylabel ('amplitude')

title ('De-modulated signal')

grid on

hold all

subplot(4,2,8)

plot(fr,demod\_f)

hold all

xlabel ('frequency(hz)')

ylabel ('amplitude')

title ('De-modulated signal')

xlim([-2000 2000])

grid on

pause(0.00001)

end

Diagram, box and whisker chart

Description automatically generated

Task 3

CODE

gt = 1;

gr = 1;

lambda = 1;

d = 1;

ht = sqrt(gt\*gr\*lambda^2/(4\*pi\*d\*d));

nt = 0.1\*randn(1, length(t));

f = 5

fs = 1000\*f

fc = 500

duration = 30

t\_lpf = -5:1/fs:5

lpf = 100\*sinc(100\*t\_lpf)

for i = 0:duration-1

t = i:1/fs:i+1

U = randi(5)

m\_t = cos(2\*pi\*U\*f\*t)

n = length(m\_t)

fr = linspace(-fs/2,fs/2, n)

m\_f = fftshift(abs(fft(m\_t)/n))

c\_s = cos(2\*pi\*fc\*t)

mod\_m\_t = m\_t.\*c\_s

%passing modulated signal through channel

mod\_m\_trans = mod\_m\_t\*ht;

%increasing power of transmitted signal;

k = 4;

mod\_m\_t\_c = k\*mod\_m\_trans;

mod\_m\_f = fftshift(abs(fft(mod\_m\_t\_c)/n))

demod\_m\_t = mod\_m\_t\_c.\*(2\*c\_s)

demod\_m\_f = fftshift(abs(fft(demod\_m\_t)/n))

demod = 2\*(conv(demod\_m\_t,lpf,'same'))

demod\_f = fftshift(abs(fft(demod)/n))

y\_t = hilbert(mod\_m\_t\_c).\*exp(-2\*j\*pi\*fc\*t)

%%% adding noise

y\_t = y\_t + nt

y\_f = fftshift(abs(fft(y\_t)/n))

% noise with changed variance

n1\_t =0.1\*normrnd(0,5);

y1\_t = y\_t + n1\_t

end

%plotting

subplot(2 ,2,1)

plot(t,mod\_m\_t)

xlabel ('time(s)')

ylabel ('amplitude')

title ('Modulated signal')

subplot(2,2,2)

plot(t,mod\_m\_trans)

xlabel ('time(s)')

ylabel ('amplitude')

title ('Transmitted signal through channel')

subplot(2,2,3)

plot(t,mod\_m\_t\_c)

xlabel ('time(s)')

ylabel ('amplitude')

title ('Transmitted signal through channel with increased power')

subplot(2,2,4)

plot(t,y\_t)

xlabel ('time(s)')

ylabel ('amplitude')

title ('Received power with added noise')

figure

plot(t,y1\_t)

xlabel ('time(s)')

ylabel ('amplitude')

title ('Added noise with variance 5')