**TASK1**

Diagram

Description automatically generated

CODE:

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

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

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

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

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')

grid on

subplot(4,2,5)

plot(t,demod\_m\_t)

xlabel ('time(s)')

ylabel ('amplitude')

title ('De-modulated signal')

grid on

hold all

subplot(4,2,6)

plot(fr,demod\_m\_f)

hold all

xlabel ('frequency(hz)')

ylabel ('amplitude')

title ('De-modulated signal(without LPF)')

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(after LPF)')

pause(0.05)

end

TASK 3:

A picture containing object, comb

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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')

TASK 2:

Code:

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

duration\_sig = 59;

f\_c = 500;

z =amdemod(y,f\_c, Fs, 0, 1);

for T = 0:duration\_sig

t = T:1/Fs:(1+T);

M\_f = fft(z)/length(z);

f = linspace(-Fs/2, Fs/2, length(z));

figure()

subplot(211);

plot(z);

subplot(212)

plot(f,fftshift(abs(M\_f)));

%modulated sound

sound(z, Fs);

%original sound

sound(y, Fs);

end

![Chart

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