Amplitude Modulation - AM

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# Variables :

clear;

fm1 =80; %% first modulating signal frequency

fm2 =120; %% second modulating signal frequency

fc =1000; %% Carrier frequency

fs =20\*fc;%% Sampling frequency

endpoint=0.1;

t =0:1/fs:endpoint; %% Time series index

l = length(t); %% Length of vector t

i=(-l/2:1:l/2-1); %% frequency series index

Vm1=1; %% Peak amplitude of first modulating signal

Vm2=2; %% Peak amplitude of second modulating signal

Vc = 5; %% Peak amplitude of carrier signal

# Modulating and Carrier signal :

v\_m\_1 = Vm1 \*cos(2\*pi\*fm1\*t);

v\_m\_2 = Vm2 \*cos(2\*pi\*fm2\*t);

v\_m=v\_m\_1+v\_m\_2; %% multi-tone signal - two-tone signal

f1=figure;

plot(t,v\_m);

xlabel("Time");

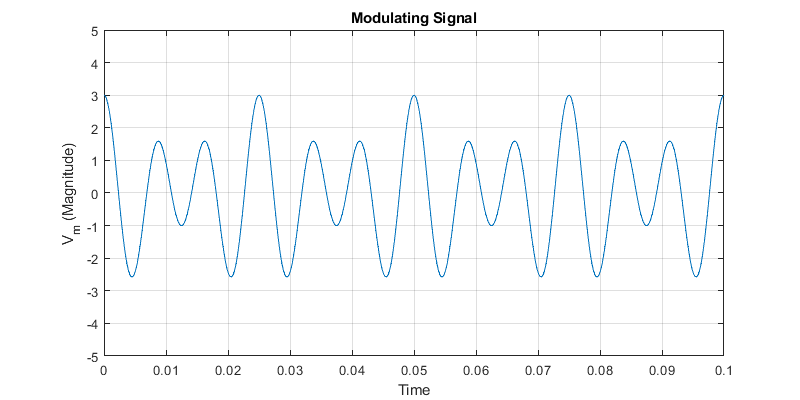
ylabel("V\_m (Magnitude)");

title("Modulating Signal");

set(f1,'Position',[0 0 800 400]);

grid on

ylim([-5.000 5.000]);



v\_c=Vc\*cos(2\*pi\*fc\*t ); %%Carrier signal expression

f2 = figure;

set(gcf,'DefaultAxesColorOrder',colormap(summer(2)));

plot(t,v\_c);

xlabel("Time (sec)");

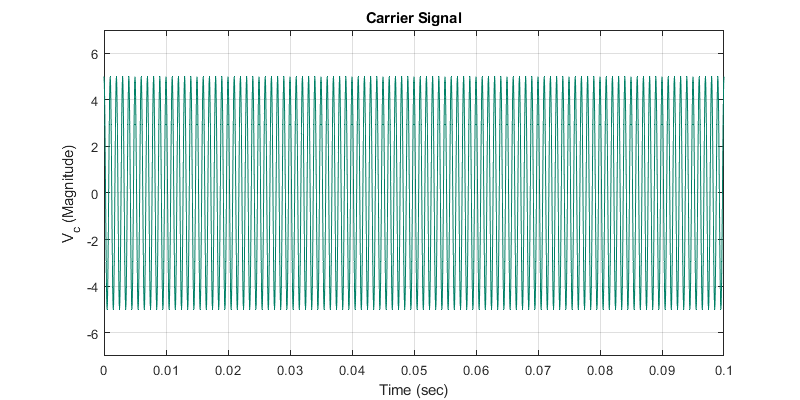
ylabel("V\_c (Magnitude)");

title("Carrier Signal");

set(f2,'Position',[0 0 800 400]);

grid on;

ylim([-(Vc+2) (Vc+2)]);



# A M Signal :

v\_am=(Vc+v\_m).\*cos(2\*pi\*fc\*t);%% multi-tone AM signal - two-tone AM signal

f3=figure;

plot(t,v\_am);

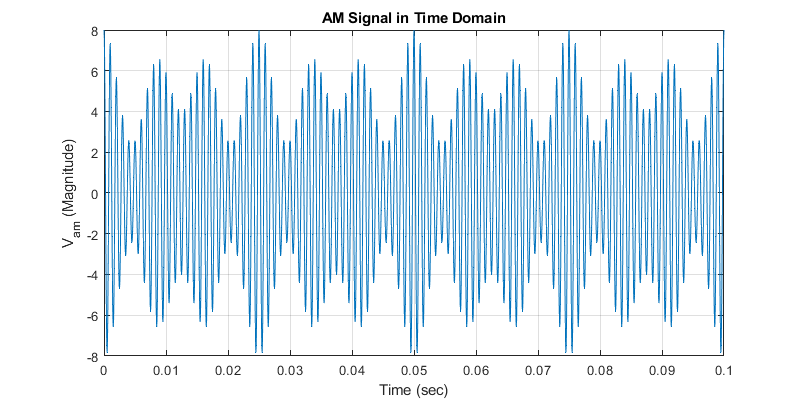
xlabel("Time (sec)") ;

ylabel("V\_a\_m (Magnitude)");

title("AM Signal in Time Domain");

set(f3,'Position',[0 0 800 400]);

grid on



# A M Spectrum :

% subplot(3,1,1);

% i =(-fs/2:fs/l:fs/2-(fs/lS));

f4=figure;

fftVam=fftshift(fft(v\_am));

plot(i\*10,abs(fftVam)); %% FFT of AM signal

title("AM Spectrum");

xlabel("Frequency (Hertz)");

ylabel("Magnitude");

set(f4,'Position',[0 0 800 400]);

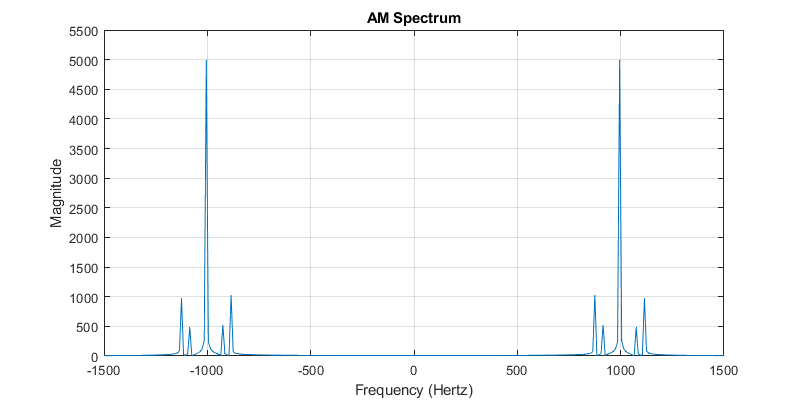
% xlim([-199 224]);

% ylim([0 5500]);

xlim([-1500 1500]);

ylim([0 5500]);

grid on;



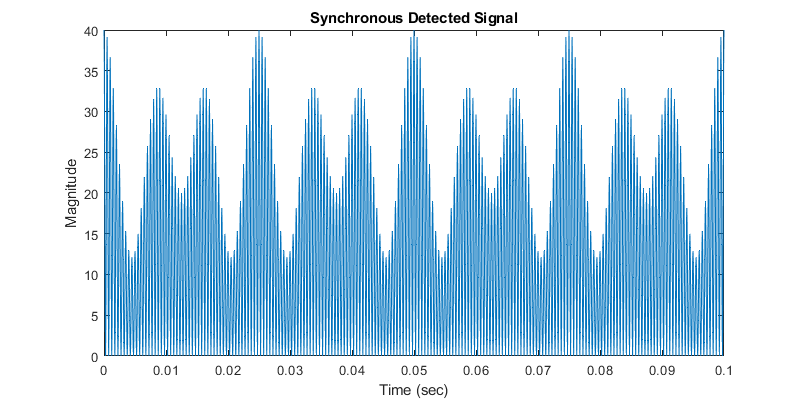
v\_m\_det=v\_am.\*v\_c; %% Synchronous detection expression

plot(t,v\_m\_det);

xlabel("Time (sec)") ;

ylabel("Magnitude");

title("Synchronous Detected Signal");



plot(i\*10,abs(fftshift(fft(v\_m\_det)))/10000);

xlabel("Frequency (Hertz)");

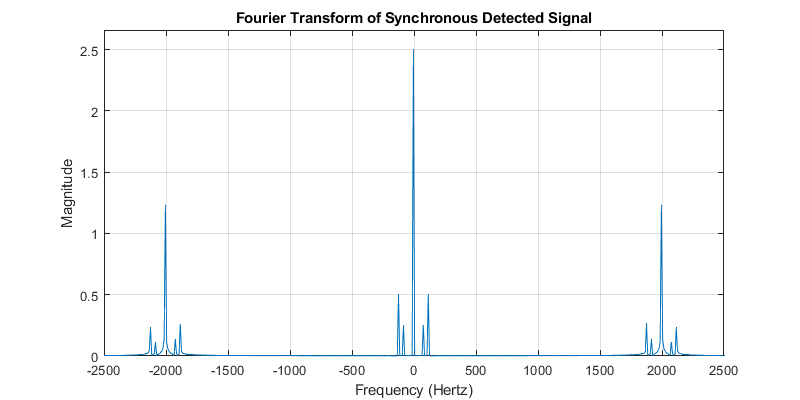
ylabel("Magnitude");

title("Fourier Transform of Synchronous Detected Signal");

xlim([-2500 2500]);

ylim([0.00 2.66]);

grid on;



# Low Pass Filter :

tuner=170;

a=round(l/2);

b=(2\*fc\*endpoint-tuner)/2;

lpf=[zeros(1,a-b),ones(1,2\*b),zeros(1,l-(2\*b+a-b))]; %%LPF response

f6=figure;

plot(i\*10,lpf);hold on

plot(i\*10,abs(fftshift(fft(v\_m\_det)))/10000);

xlabel("Frequency (Hertz)");

ylabel("Magnitude");

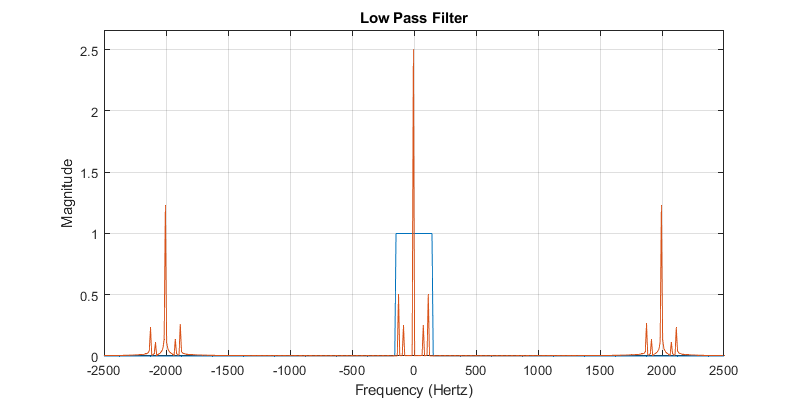
title("Low Pass Filter");

set(f6,'Position',[0 0 800 400]);

xlim([-2500 2500]);

ylim([0.00 2.66]);

grid on;



# Demodulated Signal :

v\_m\_demod\_spec = (fftshift(fft(v\_m\_det))).\*lpf ; %%Frequency domain profile of demodulated signal

f5=figure;

plot(t,v\_m\*2.569);hold on %% original signal-- blue

% plot(t,-12.504+abs(ifftshift(ifft(v\_m\_demod\_spec))));

plot(t,abs(ifftshift(ifft(v\_m\_demod\_spec)))); %% Final time domain plot of demodulated signal -- orange

xlabel("Time (sec)");

ylabel("V\_m Demodulated (magnitude)") ;

title("Demodulated and Original Signal");

set(f5,'Position',[0 0 800 400]);

grid on;

