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%BATCH - 2017
%BRANCH - ECE, SEM-5, GP- G2, G-6
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%AIM - STUDY OF FREQUENCY DIVISION MULTIPLEXING AND DEMULTIPLEXING
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clear;
close all;
clc;
figure(1);
%DSB-SC modulated signal 1
Am1=2;
fm1=50;
fc1=200;
fs=10000;
ts=1/fs;
N = 2048*2;
f=(-N/2:1:(N/2-1))*fs/N;
t=(0:ts:0.3);
c1= cos(2*pi*fc1*t);
m1=Am1*sin(2*pi*fm1*t);
xc1 = m1.*c1;
subplot(3,2,1);
plot(t,m1);
title('Fig 1.1 m1(t)');
ylabel('Amplitude');
xlabel('t->');
subplot(3,2,2);
XC1 = fftshift(fft(xc1,N));
plot(f,abs(XC1));
title('Fig. 1.2 Modulated signal in frequency');
ylabel('Amplitude');
xlabel('f (scaled)');

%DSB-SC modulated signal 2
Am2=4;
fm2=50;
fc2=400;
c2= cos(2*pi*fc2*t);
m2=Am2*square(2*pi*fm2*t);
xc2 = m2.*c2;
XC2 = fftshift(fft(xc2,N));
subplot(3,2,3);
plot(t,m2);
title('Fig. 1.3 m2(t)');
ylabel('Amplitude');

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xlabel('t->');
subplot(3,2,4);
plot(f,abs(XC2));
title('Fig 1.4 Modulated signal in frequency');
ylabel('Amplitude');
xlabel('f (scaled)');

%DSB-SC modulated signal 3
Am3=10;
fm3=50;
fc3=600;
m3=Am3*sawtooth(2*pi*fm3*t);
c3= cos(2*pi*fc3*t);
xc3 = m3.*c3;
XC3 = fftshift(fft(xc1,N));
subplot(3,2,5);
plot(t,m3);
title('Fig 1.5 m3(t)');
ylabel('Amplitude');
xlabel('t->');
subplot(3,2,6);
plot(f,abs(XC3));
title('Fig 1.6 Modulated signal in frequency');
ylabel('Amplitude');
xlabel('f (scaled)');

%one group channel with three modulated signals muxed
mux = xc1 + xc2 + xc3;
figure(2);
MUX = fft(mux,N);
plot(f,abs(MUX));
title('Fig. 2 Multiplexed group channel signal');
ylabel('Magnitude');
xlabel('f');

%demultiplexing
mux1 = mux.*c1;
mux2 = mux.*c2;
mux3 = mux.*c3;
[num1,den1] = butter(10,(fc1)/fs);
[num2,den2] = butter(10,(fc2)/fs);
[num3,den3] = butter(10,(fc3)/fs);

y1=filter(num1,den1,mux1);
y2=filter(num2,den2,mux2);
y3=filter(num3,den3,mux3);

figure(3);
subplot(3,2,1);
plot(t,m1);
title('Fig. 3.1 m1(t)');
ylabel('Amplitude');
xlabel('time');
subplot(3,2,2);

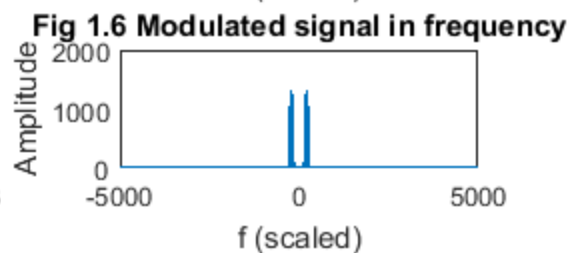
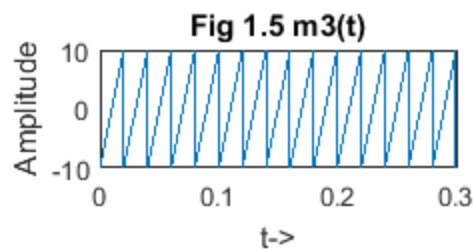
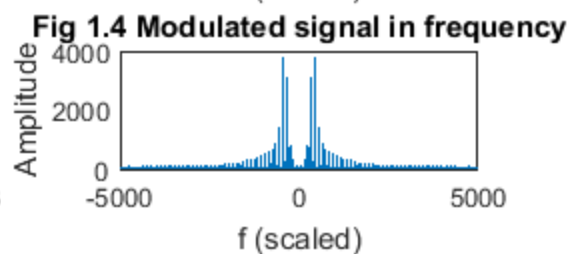
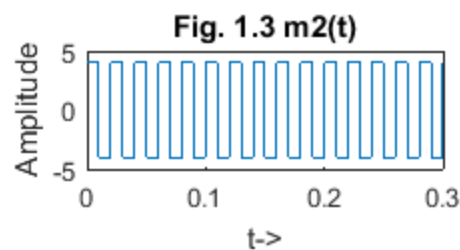
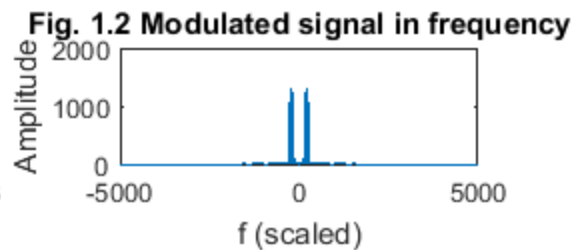
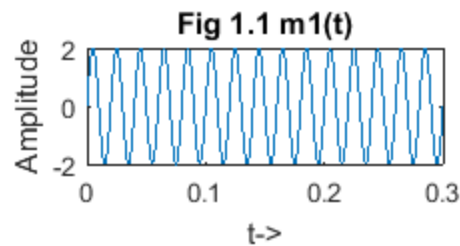
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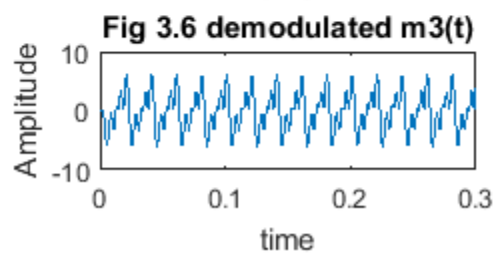
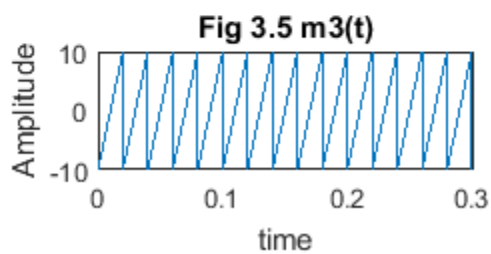
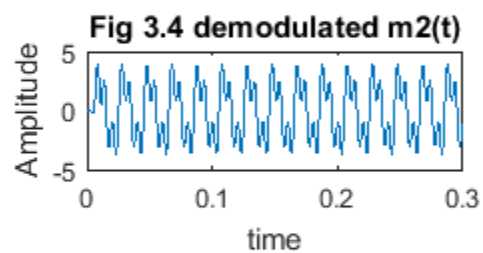
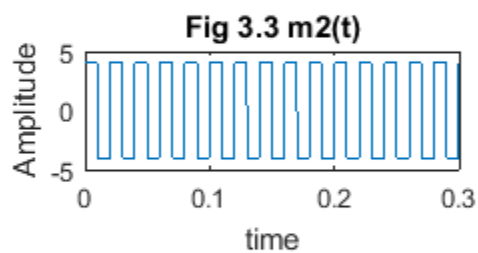
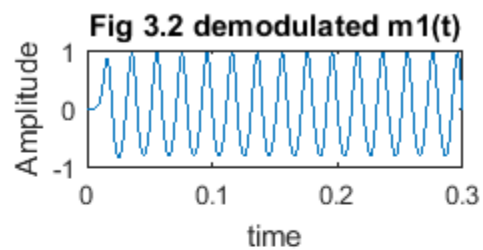
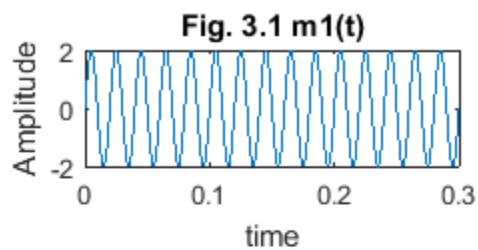
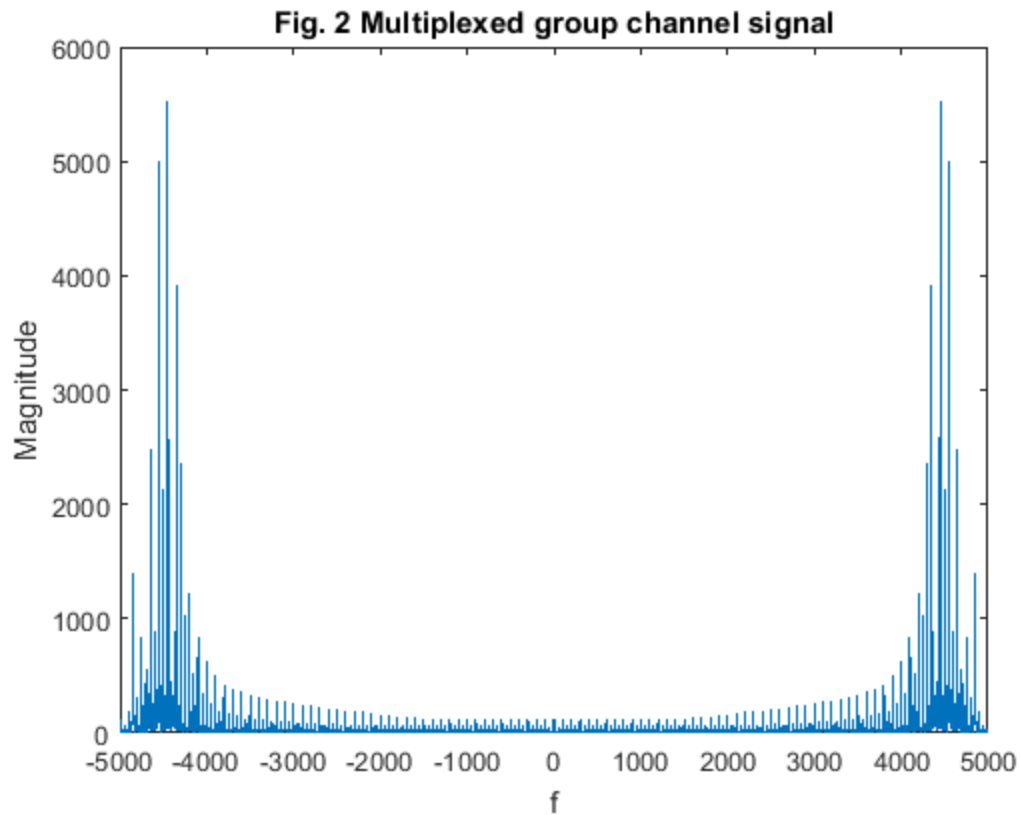
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plot(t,y1);
title('Fig 3.2 demodulated m1(t)');
ylabel('Amplitude');
xlabel('time');
subplot(3,2,3);
plot(t,m2);
title('Fig 3.3 m2(t)');
ylabel('Amplitude');
xlabel('time');
subplot(3,2,4);
plot(t,y2);
title('Fig 3.4 demodulated m2(t)');
ylabel('Amplitude');
xlabel('time');
subplot(3,2,5);
plot(t,m3);
title('Fig 3.5 m3(t)');
ylabel('Amplitude');
xlabel('time');
subplot(3,2,6);
plot(t,y3);
title('Fig 3.6 demodulated m3(t)');
ylabel('Amplitude');
xlabel('time');

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*Published with MATLAB® R2016a*