function y = lambda(t)

% unit triangular pulse

y=1-abs(t);

y(t>=1)=0;

y(t<=-1)=0;

end

deltat=1/300;

tmax=1.5;

t=-tmax:deltat:tmax;

x=lambda(2\*t);

[X,omega]=CTFT\_approx(x,t);

phi = 0;

figure(1);

subplot(211);

plot(t,x);

l=get(gca,'children');set(l,'linewidth',1.5)

set(gca,'FontName','arial');set(gca,'FontSize',14);

xlabel('Time \itt\rm (s)');

ylabel('\itx\rm(\itt\rm)');

grid on;

title('Message Signal and Spectrum');

subplot(212);

plot(omega/(2\*pi),abs(X));

l=get(gca,'children');set(l,'linewidth',1.5)

set(gca,'FontName','arial');set(gca,'FontSize',14);

xlabel('Frequency \omega/2\pi (Hz)');

ylabel('|\itX\rm(\itj\rm\omega)|');

grid on;

fc = 50;

omegac = 2\*pi\*fc;

y=x.\*cos(omegac\*t);

[Y,omega2]=CTFT\_approx(y,t);

figure(2);

subplot(211);

plot(t,y);

l=get(gca,'children');set(l,'linewidth',1.5)

set(gca,'FontName','arial');set(gca,'FontSize',14);

xlabel('Time \itt\rm (s)');

ylabel('\ity\rm(\itt\rm)');

grid on;

title('Modulated Signal and Spectrum');

subplot(212);

plot(omega/(2\*pi),abs(Y));

l=get(gca,'children');set(l,'linewidth',1.5)

set(gca,'FontName','arial');set(gca,'FontSize',14);

xlabel('Frequency \omega/2\pi (Hz)');

ylabel('|\itY\rm(\itj\rm\omega)|');

grid on;

v=1/2\*x\*cos(phi)+1/2\*x.\*cos(2\*omegac\*t+phi);

[V,omega3]=CTFT\_approx(v,t);

figure(3);

subplot(211);

plot(t,v);

l=get(gca,'children');set(l,'linewidth',1.5)

set(gca,'FontName','arial');set(gca,'FontSize',14);

xlabel('Time \itt\rm (s)');

ylabel('\itv\rm(\itt\rm)');

grid on;

title('Demodulated Signal and Spectrum');

subplot(212);

plot(omega3/(2\*pi),abs(V));

l=get(gca,'children');set(l,'linewidth',1.5)

set(gca,'FontName','arial');set(gca,'FontSize',14);

xlabel('Frequency \omega/2\pi (Hz)');

ylabel('|\itV\rm(\itj\rm\omega)|');

grid on;

fn=5;omegan=2\*pi\*fn;

hlpf=hsolpfcd(t,omegan);

[H,omega4]=CTFT\_approx(hlpf,t);

magnitude=abs(H);

phase=angle(H);

figure(4);

subplot(311)

plot(t,hlpf);

l=get(gca,'children');set(l,'linewidth',1.5)

set(gca,'FontName','arial');set(gca,'FontSize',14);

xlabel('Time \itt\rm (s)');

ylabel('\ith\rm(\itt\rm)');

grid on;

title('Impulse Response of LPF');

subplot(312);

plot(omega4/(2\*pi),magnitude);

l=get(gca,'children');set(l,'linewidth',1.5)

set(gca,'FontName','arial');set(gca,'FontSize',14);

xlabel('Frequency \omega/2\pi (Hz)');

ylabel('|\itH\rm(\itj\rm\omega)|');

grid on;

subplot(313);

plot(omega4/(2\*pi),phase);

l=get(gca,'children');set(l,'linewidth',1.5)

set(gca,'FontName','arial');set(gca,'FontSize',14);

xlabel('Frequency \omega/2\pi (Hz)');

ylabel('<\itH\rm(\itj\rm\omega)');

grid on;

tw=-2\*tmax:deltat:2\*tmax;

w=deltat\*conv(v,hlpf);

[W,omega9]=CTFT\_approx(w,tw);

figure(5);

subplot(211);

plot(tw,w);

l=get(gca,'children');set(l,'linewidth',1.5)

set(gca,'FontName','arial');set(gca,'FontSize',14);

xlabel('Time \ittw\rm (s)');

ylabel('\itw\rm(\itt\rm)');

%ylim([0,0.5])

xlim([-1.5,1.5])

grid on;

title('Filted Signal and Spectrum');

subplot(212);

plot(omega9/(2\*pi),abs(W));

l=get(gca,'children');set(l,'linewidth',1.5)

set(gca,'FontName','arial');set(gca,'FontSize',14);

xlabel('Frequency \omega/2\pi (Hz)');

ylabel('|\itW\rm(\itj\rm\omega)|');

%ylim([0,0.5])

grid on;



 



5.

The filtered signal w(t) has 1. Small leakage of the 2 wc component; 2. Amplitude distortion; 3. Time delay. Possible improvement: reduce the LPF cut off frequency; use a higher order filter with a higher cut-off frequency.

6.

Phase offsets of phi=0, pi/2, and pi yield lowpass filter outputs w(t) = ½ x(t), 0, and -1/2 x(t).

Phase of ½ pi is worst since no signal is recovered.

7.

Phi=1/2\*pi:





Phi = pi:



