```
clear all; close all;
% t=0:0.01:20;c=1;u0=1/(2*c);tt=t(501:1501);
% h=zeros(size(t));h(951:1051)=1;%note area=1s*1=1.
% f=2*cos(2*pi*u0*t);plot(tt,f(501:1501),tt,h(501:1501),'r');hold on
% g=conv(h,f,'same')*0.01;plot(tt,g(501:1501),'k');hold off
%

% N=12;h=zeros(1,N);h(1:3)=1/6;h(10:12)=1/6;%h has area one
% H(1,:)=h;
% for j=2:N
%     H(j,j:N)=h(1:N-j+1);H(j,1:j-1)=h(N-j+2:N);
% end
% imagesc(H);colormap gray; axis square
% f=2*cos(2*pi*[1:12]/12)';
% g=H*f;figure;plot(f);hold on;plot(g,'k');hold off

clear all; close all; %
N=256;Tt=1; %Number of pts in waveform and Tt=total duration in
dt=Tt/N; %sampling interval in s.
t=dt:dt:Tt; %time axis (important to begin after first incremen
G(:,1) = 1.0*sin(2*pi*1*t)'; %generate time-harmonic functions...
G(:,2) = 2.0*cos(2*pi*1*t)'; %(notice the tick marks making column vectors.)
G(:,3) = 1.5*sin(2*pi*2*t)'; %cos(2pi ut)=sin(2pi ut + pi/2)
G(:,4) = 3.0*cos(2*pi*2*t)'; %We have sines and cosines at 1,2,3,and 3.5 Hz.
G(:,5) = 2.5*sin(2*pi*3*t)'; %
G(:,6) = 1.75*cos(2*pi*3.5*t); %Non-harmonic waveform
%psi = G'*G
psi = cov(G) %covariance matrix (zero lag, no norm, zero mean).
rho = corrcoef(G)
%
%Expand the sum of three cosine functions in a Fourier series.
t=0:0.01:10; %set a 10s time axis. T=0.01s and T0=10s
g1 = 1.5*cos(2*pi*1*t); %three time-harmonic functions...
g2 = 3.0*cos(2*pi*10*t);%
g3 = 4.5*cos(2*pi*25*t);%
g=g1+g2+g3; %...summed to give g(t). u selected are 1,10,25 Hz
%
for k=0:300; %for a basis set beginning at u0=1/T0=0.1 Hz at
%multiples up to 30Hz. I need to know when to
%stop, which means I need to know the bandwidth of g(t).
C(:,k+1)=cos(2*pi*k*t/10)'; %notice the tick takes a transpose, so column
vector.
end %Notice the number of frequencies (300) does not have to...
%...equal the number of waveform points as it does in FFT.
A=2/10*g*C*0.01; %compute correlation integral at tau=0. dt=T=0.01s.
%This row vector holds the Fourier cosine coefficients.
%The integral is found from the matrix multiplication.
u=0:0.1:30; %Create a frequency axis for plotting.
%Note that du=1/T=0.1Hz; U0=30 set above
subplot(3,1,1);plot(t,g);subplot(3,1,2);stem(u,A); %
G=fft(g); %Let's try another approach using Fourier transforms...
subplot(3,1,3);stem(u,2.0/10*abs(G(1:301))*0.01) %...and plot the magnitude
of the result.
%
```