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```
syms t

T = 1 ;%period
w0 = 2*pi/T ;
a0 = 1/T * int(t,t,0,1)%integral to find a0

power = 1/T *int(t.^2,t,0,1) % the power in all signal
hpow = a0 .^2 ; %harmunic power

an =0;
bn = 0 ;
hpowPlot =hpow.*(heaviside(t+0.001) - heaviside(t-0.001)) ;%harmunic power to
plot
for n = 1:1:3
sprintf('The harmonic # %d',n)
an =an+ 2/T * int(t*cos(n*w0*t),t,0,1)*cos(n*w0*t);

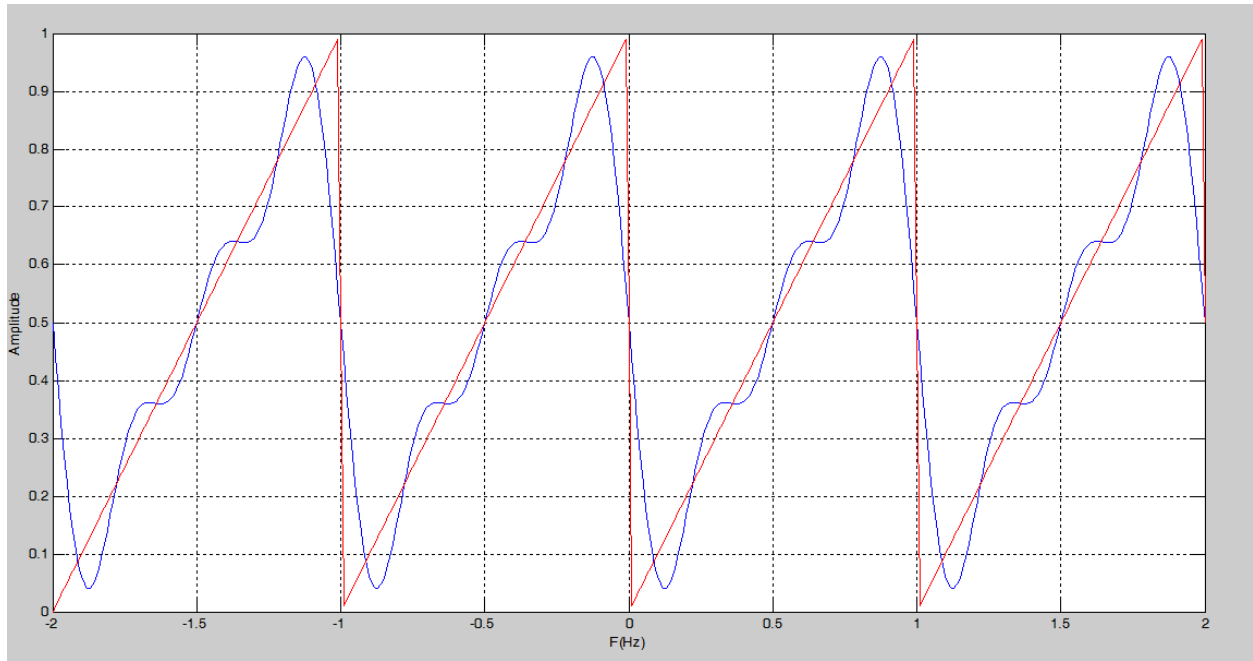
bn =bn+ 2/T * int(t*sin(n*w0*t),t,0,1)*sin(n*w0*t);

disp(int(t*cos(n*w0*t),t,0,1)*cos(n*w0*t) +
int(t*sin(n*w0*t),t,0,1)*sin(n*w0*t));

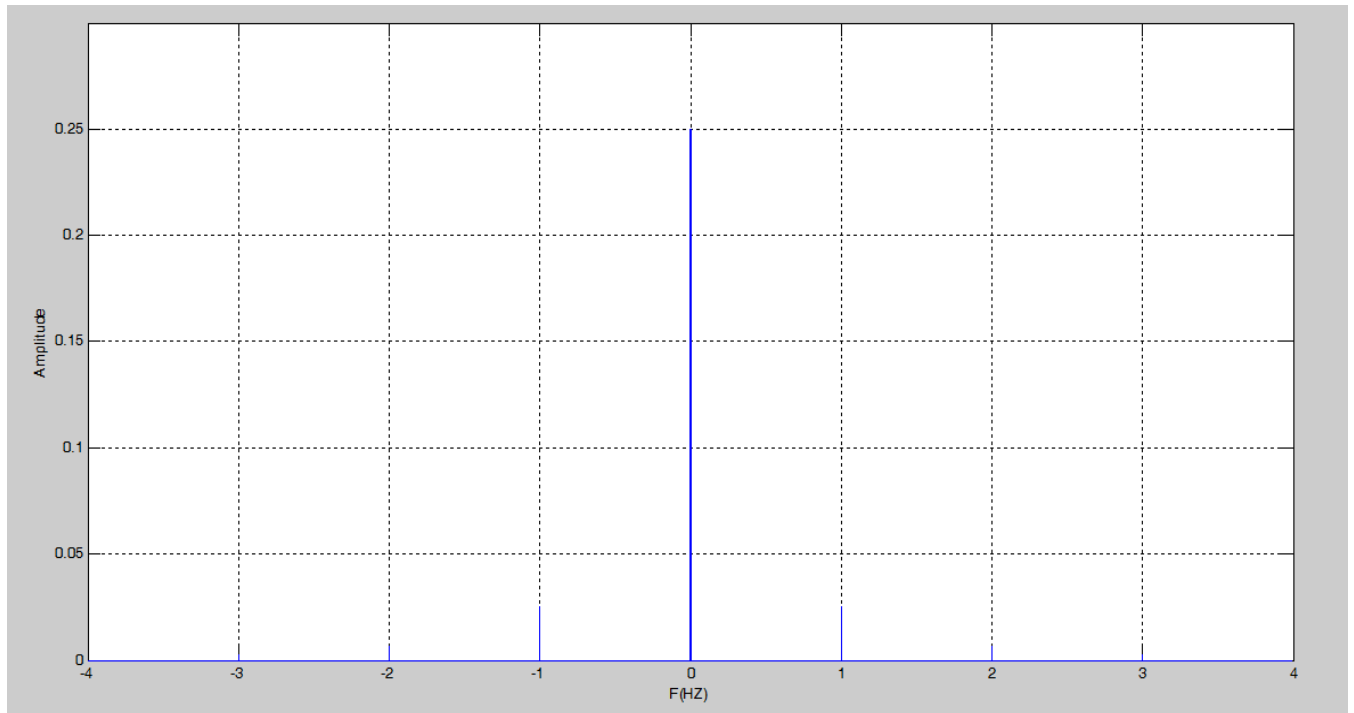
%find the power of each harmonic and preper to plot
hpow = hpow + 0.5*((2/T * int(t*cos(n*w0*t),t,0,1)).^2 + (2/T *
int(t*sin(n*w0*t),t,0,1)).^2);
hpowPlot = hpowPlot+0.25*((2/T * int(t*cos(n*w0*t),t,0,1)).^2 + (2/T *
int(t*sin(n*w0*t),t,0,1)).^2).* (heaviside(t+0.001+n) - heaviside(t-0.001+n))
+ 0.25*((2/T * int(t*cos(n*w0*t),t,0,1)).^2 + (2/T *
int(t*sin(n*w0*t),t,0,1)).^2).* (heaviside(t+0.001-n) - heaviside(t-0.001-n))
;
end
r = -2:0.01:2 ;
% the power in 3 harmonics
disp('POWER IS :');
hpow

plot(r,subs(bn+an+a0,r)) ;
hold on;
x=0;
% Draw the sawtooth signal
for n = -2:2
x = x+(t-n).* heaviside(t-n) - heaviside(t-1-n) - (t-1-n).*heaviside(t-1-n);
end
%spectral density
x = subs(x,r);
plot(r,x,'r')
grid on;
figure
k = -4:0.0003:4 ;
hpowPlot = subs(hpowPlot,k);
plot(k,hpowPlot);
axis([-4 4 0 0.3])
grid on
```

{Compare the original signal with 3 harmonics}



{Spectral Density}



{Sample Output}

```
>> Untitled  
  
a0 =  
  
1/2  
  
power =  
  
1/3  
  
ans =  
  
The harmonic # 1  
  
-sin(2*pi*t)/(2*pi)  
  
ans =  
  
The harmonic # 2  
  
-sin(4*pi*t)/(4*pi)
```

```
The harmonic # 3  
  
-sin(6*pi*t)/(6*pi)  
  
POWER IS :  
  
hpow =  
  
49/(72*pi^2) + 1/4  
  
>> 49/(72*pi^2) + 1/4  
  
ans =  
  
0.3190
```

```
>> (49/(72*pi^2) + 1/4)/(1/3)  
  
ans =  
  
0.9569
```

- Power of original signal = 1/3.
- Power of 3rd harmonics = 0.3190 .
- The ratio is 95.69% .