Fourier Analysis

Example

Given a signal

$$y(t) = 150 \sin(\omega t) + 60 \sin(3\omega t)$$

where $\omega = 2\pi f$ and $f = 50$ Hz;

Find the spectrum amplitudes of signal $y(t)$.

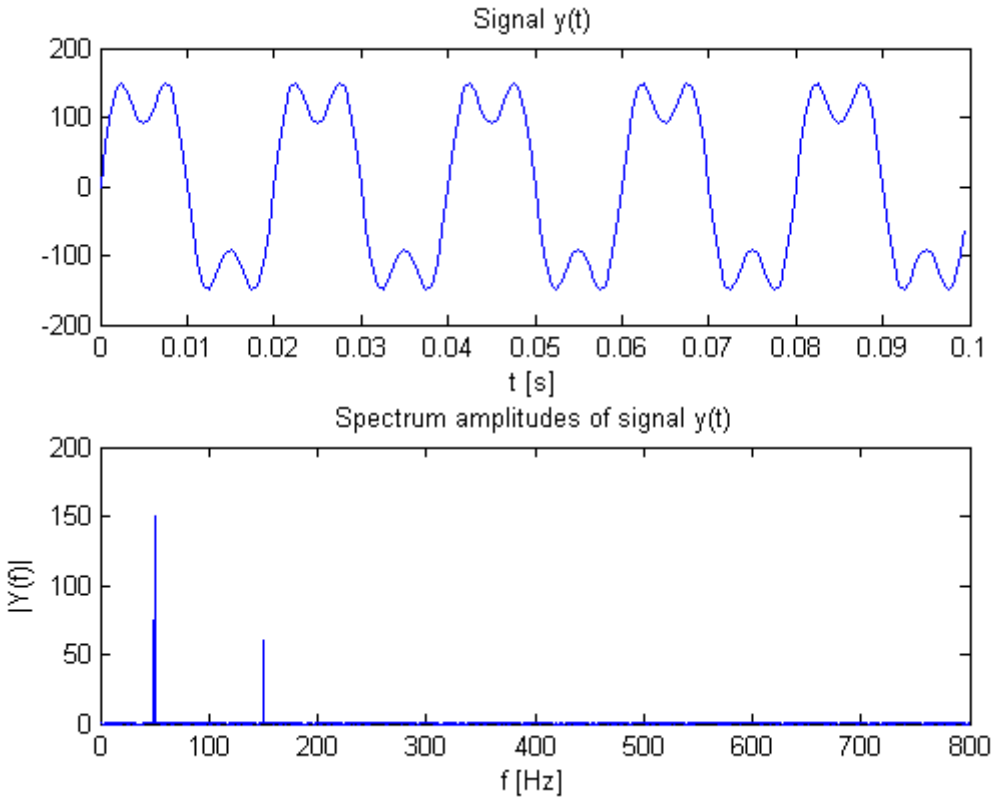
Solution

The MATLAB program that can be used to plot the signal $y(t)$ and obtain the power spectrum amplitudes of signal $y(t)$ is

MATLAB Script

```
clear; clc;
f=50;    % basic signal frequency
fs=f*2^5 % sampling frequency (FFT requires that fs=f*2^number)
dt=1/fs;
n=fs*4   % total samples (FFT requires that n=2^number, e.g. n=fs*4)
t=[0:n-1]*dt; % vector of times
w=2*pi*f;
y=150*sin(w*t)+60*sin(3*w*t);  % definition of signal y(t)
subplot(2,1,1);
% plots signal y(t) by means of the first 160 samples
plot(t(1:160),y(1:160));
title('Signal y(t)');
xlabel('t [s]');
Y=fft(y);     % performs FFT for samples of signal y(t)
fx=linspace(0,fs/2,n/2); % fx from 0 to fs/2, total of n/2 values
% It forms a frequency axis for the first half of points
% and uses it to plot the result. The remaining points are
% symmetric.
subplot(2,1,2);
plot(fx,2*abs(Y(1:n/2))/n);
title('Spectrum amplitudes of signal y(t)');
xlabel('f [Hz]'); ylabel('|Y(f)|');
```

The plots obtained from MATLAB are



Notice the peaks at 50 Hz and 150 Hz. These are the frequencies of the signal.