

**7.27** Consider the following periodic analog signal with three harmonics.

$$x_a(t) = \sin(2\pi t) - 3 \cos(4\pi t) + 2 \sin(6\pi t)$$

Suppose this signal is sampled at  $f_s = 24$  Hz using  $N = 50$  samples to produce a discrete-time signal  $x(k) = x_a(kT)$  for  $0 \leq k < N$ . Write a MATLAB script that uses *f\_interpol* to interpolate this signal by converting it to a sampling rate of  $f_S = 72$  Hz. For the anti-imaging filter use a least-squares filter of order  $m = 50$ . Use the *subplot* command and the *stem* function to plot the following discrete-time signals on the same screen.

- (a) The original signal  $x(k)$
- (b) The resampled signal  $y(k)$  below it using a different color.

### Solution

```
% Problem 7.27

% Construct signal

clear
clc
N = 50;
fs = 24;
T = 1/fs;
k = 0 : N-1;
theta = 2*pi*k*T;
x = sin(theta) - 3*cos(2*theta) + 2*sin(3*theta);

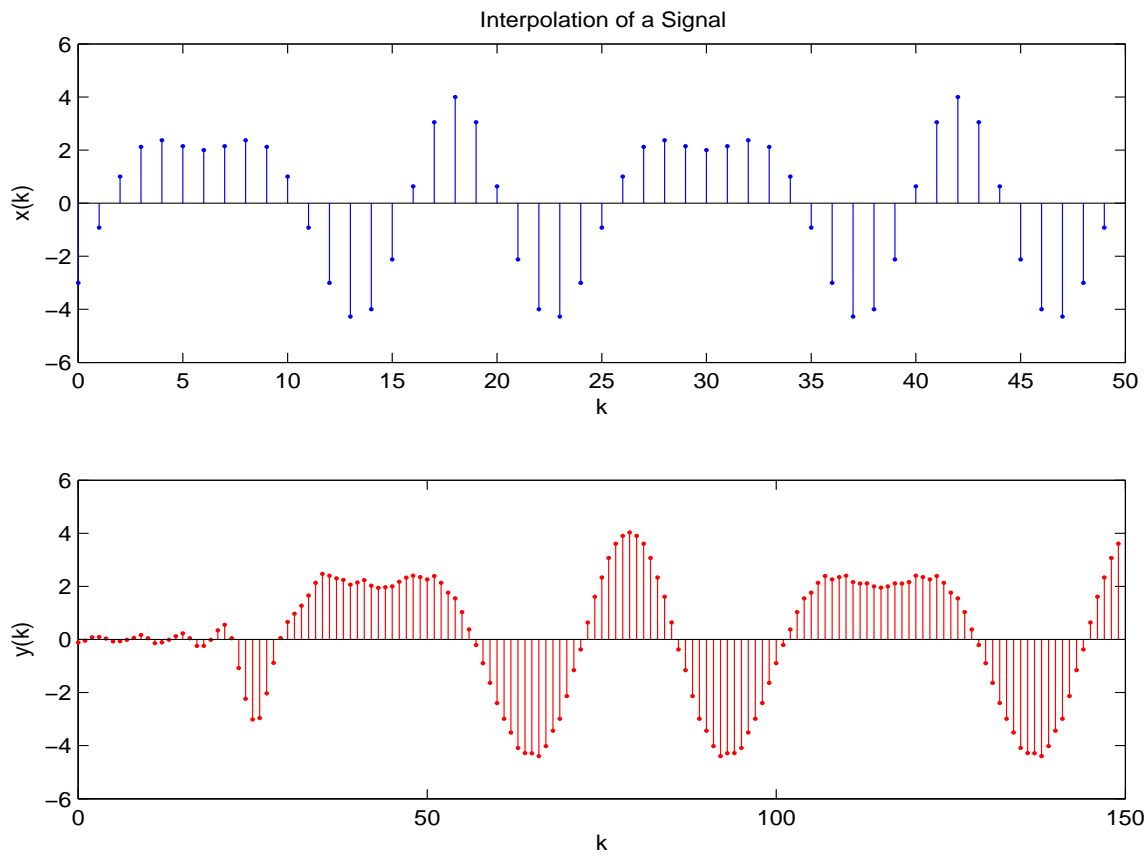
% Resample

fS = 72;
L = fS/fs
m = 50;
f_type = 5;
[y,b] = f_interpol (x,fs,L,m,f_type);

% Plot both signals

figure
subplot (2,1,1)
stem (k,x,'.','filled')
axis ([0 length(x) -6 6])
f_labels ('Interpolation of a Signal','k','x(k)')
subplot (2,1,2)
stem ([0: length(y)-1],y,'r','filled')
```

```
axis ([0 length(y) -6 6])
f_labels ('','k','y(k)')
f_wait
```



**A Resampled Signal Using Interpolation**