Fourier Series

```
clc
clear all
syms x
ll=input('Enter the lower limit : ');
ul=input('Enter the upper limit : ');
l=(ul-ll)/2
pr=input('Enter the partition of [2,2l] as a vector : ')
f=input('Enter the periodic function f as a vector : ')
M=input('Enter the number of terms in the Fourier Series : ')
for n=1:M
    for i=1:length(pr)-1
        aa_0(i)=int(f(i),x,pr(i),pr(i+1));
        aa(i)=int(f(i)*cos(n*pi*x/l),x,pr(i),pr(i+1));
        bb(i)=int(f(i)*sin(n*pi*x/l),x,pr(i),pr(i+1));
    end
    a_0=vpa((1/l)*sum(aa_0),3);
    a(n)=vpa((1/l)*sum(aa),3);
    b(n)=vpa((1/l)*sum(bb),3);
    F(n)=a(n)*cos(n*pi*x/l) + b(n)*sin(n*pi*x/l);
end
disp('The Fourier series for the functio f upto M terms is as
follows : ')
F_S=(a_0/2)+sum(F);
disp(vpa(F_S,3))
g1=ezplot(a_0/2,[ll,ul])
set(g1,'color','k')
hold on
h1=ezplot(F_S,[ll,ul])
set(h1,'color','r')
```

Problem-1 :

Enter the lower limit : -pi

Enter the upper limit : pi

l =

3.1416

Enter the partition of [2,2l] as a vector : [-pi 0 pi]

pr =

-3.1416 0 3.1416

Enter the periodic function f as a vector : [-1 1]

f =

-1 1

Enter the number of terms in the Fourier Series : 10

M =

10

The Fourier series for the functio f upto M terms is as follows :

0.141*sin(9.0*x) + 0.255*sin(5.0*x) + 0.424*sin(3.0*x) + 0.182*sin(7.0*x) + 1.27*sin(x)

g1 =

Line with properties:

Color: [0 0.4470 0.7410]
LineStyle: '-'
LineWidth: 0.5000
Marker: 'none'
MarkerSize: 6

MarkerFaceColor: 'none'

XData: [1x434 double]

YData: [1x434 double]

ZData: [1x0 double]

Show all properties

h1 =

Line with properties:

Color: [0.8500 0.3250 0.0980]

LineStyle: '-'

LineWidth: 0.5000

Marker: 'none'

MarkerSize: 6

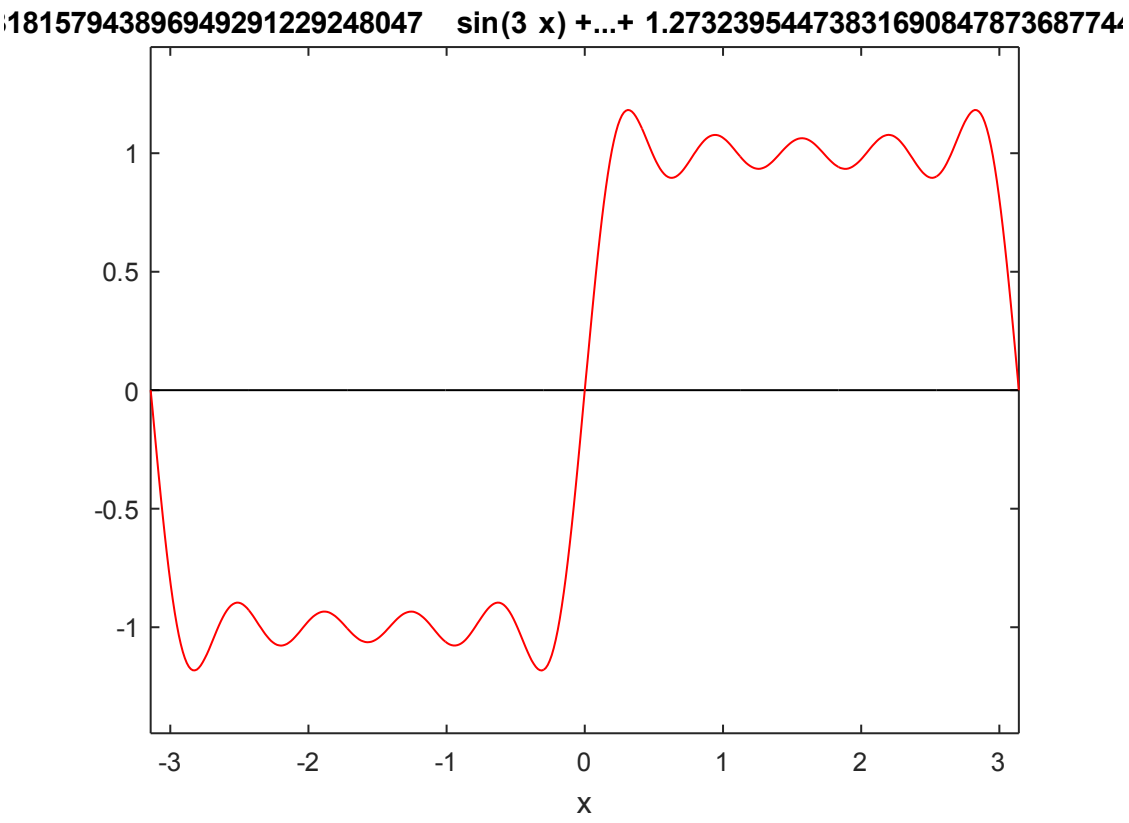
MarkerFaceColor: 'none'

XData: [1x434 double]

YData: [1x434 double]

ZData: [1x0 double]

Show all properties



Problem-2 :

Enter the lower limit : -pi

Enter the upper limit : pi

l =

3.1416

Enter the partition of [2,2l] as a vector : [-pi 0 pi]

pr =

-3.1416 0 3.1416

Enter the periodic function f as a vector : [-sin(x) sin(x)]

f =

[-sin(x), sin(x)]

Enter the number of terms in the Fourier Series : 10

M =

    10

The Fourier series for the functio f upto M terms is as follows :

0.637 - 0.0849*cos(4.0*x) - 0.0202*cos(8.0*x) - 0.0129*cos(10.0*x) - 0.0364*cos(6.0*x) - 0.424*cos(2.0*x)

g1 =

  Line with properties:

            Color: [0 0.4470 0.7410]
        LineStyle: '-'
        LineWidth: 0.5000
           Marker: 'none'
       MarkerSize: 6
  MarkerFaceColor: 'none'
            XData: [1x434 double]
            YData: [1x434 double]
            ZData: [1x0 double]

Show all properties

h1 =

Line with properties:

Color: [0.8500 0.3250 0.0980]
LineStyle: '-'
LineWidth: 0.5000
Marker: 'none'
MarkerSize: 6
MarkerFaceColor: 'none'
XData: [1x434 double]
YData: [1x434 double]
ZData: [1x0 double]

Show all properties

561977236915845423936843872 07 -...- 0.424413181579438969492912292480 47 c