

# Matlab

## Lab8

### Question:-

2. **Forced Oscillations under a Nonsinusoidal Periodic Driving Force:**  
The forced oscillations of a body of mass  $m$  on a spring of modulus  $k$  are governed by the ODE

$$my'' + cy' + ky = r$$

Find the steady-state solution for  $y(t)$ , if  $m = 1$  kg,  $c = 0.05$ g/sec and  $k = 25$  g/sec<sup>2</sup>. Where,

$$f(x) = \begin{cases} t + \pi/2 & -\pi \leq t \leq 0 \\ t - \pi/2 & 0 \leq t \leq \pi \end{cases}$$

where,  $r(t) = r(t + 2\pi)$ .

### Code in matlab:

```

1 - clc
2 - clear all
3 - syms x k L U n
4 - f=input('Enter function:');
5 - L=input('Enter lower limit:');
6 - U=input('Enter upper limit:');
7 - l=(U-L)/2;
8 - n=input('Enter no of elements required:');
9 - ak= @(f,x,k) int(f*cos(k*pi*x/l)/l,x,L,U);
10 - bk= @(f,x,k) int(f*sin(k*pi*x/l)/l,x,L,U);
11 - fs= @(f,x,n) ak(f,x,0)/2 + ...
12 - symsum(ak(f,x,k)*cos(k*pi*x/l) + bk(f,x,k)*sin(k*pi*x/l),k,l,n);
13 - pretty(fs(f,x,n))
14 - fst=ak(f,x,0)/2;
15 - for i = 1:n
16 -     fst=fst + ak(f,x,i)*cos(i*pi*x/l) + bk(f,x,i)*sin(i*pi*x/l);
17 -     disp(['harmonics upto:',num2str(i)]);
18 -     disp(fst);
19 -     figure(i);
20 -     h=ezplot(f,[L,U]);
21 -     set(h,'LineWidth',1.5);
22 -     hold on
23 -     h=ezplot(fst,[L,U]);
24 -     set(h,'LineStyle','-','Color',[i/n,l/n,l/n],'LineWidth',1.5);
25 -     title(['Partial sums up to n=',num2str(i)])
26 - end

```

Output:

Enter function: $x^2-5x+6$

Enter lower limit:0

Enter upper limit:2

Enter no of elements required:2

$4 \cos(\pi x) - \cos(2 \pi x) - 6 \sin(\pi x) - \sin(2 \pi x) + \frac{3}{3} - \frac{7}{3}$

----- + ----- + ----- + ----- + -  
 $\frac{4}{\pi^2} - \frac{1}{\pi^2} - \frac{6}{\pi} - \frac{1}{\pi} + \frac{3}{3} - \frac{7}{3}$

harmonics upto:1

$(4 \cos(\pi x))/\pi^2 + (6 \sin(\pi x))/\pi + 7/3$

harmonics upto:2

$(4 \cos(\pi x))/\pi^2 + \cos(2 \pi x)/\pi^2 + (6 \sin(\pi x))/\pi + (3 \sin(2 \pi x))/\pi + 7/3$

