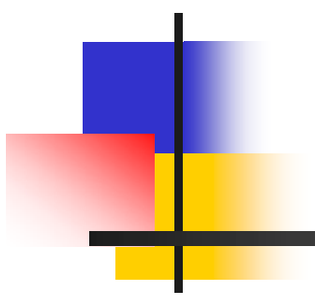
Fourier Series Practise by Matlab



Fourier series approximation of function

$$t = 2\sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n} \sin\ nt$$

- $-\pi < t < \pi$
- n= 4

Command “for”

- Repeated calculation statements
- Description
  - -The general format is

```
for  variable=expression
     statement
     ..........
     statement
```

MATLAB

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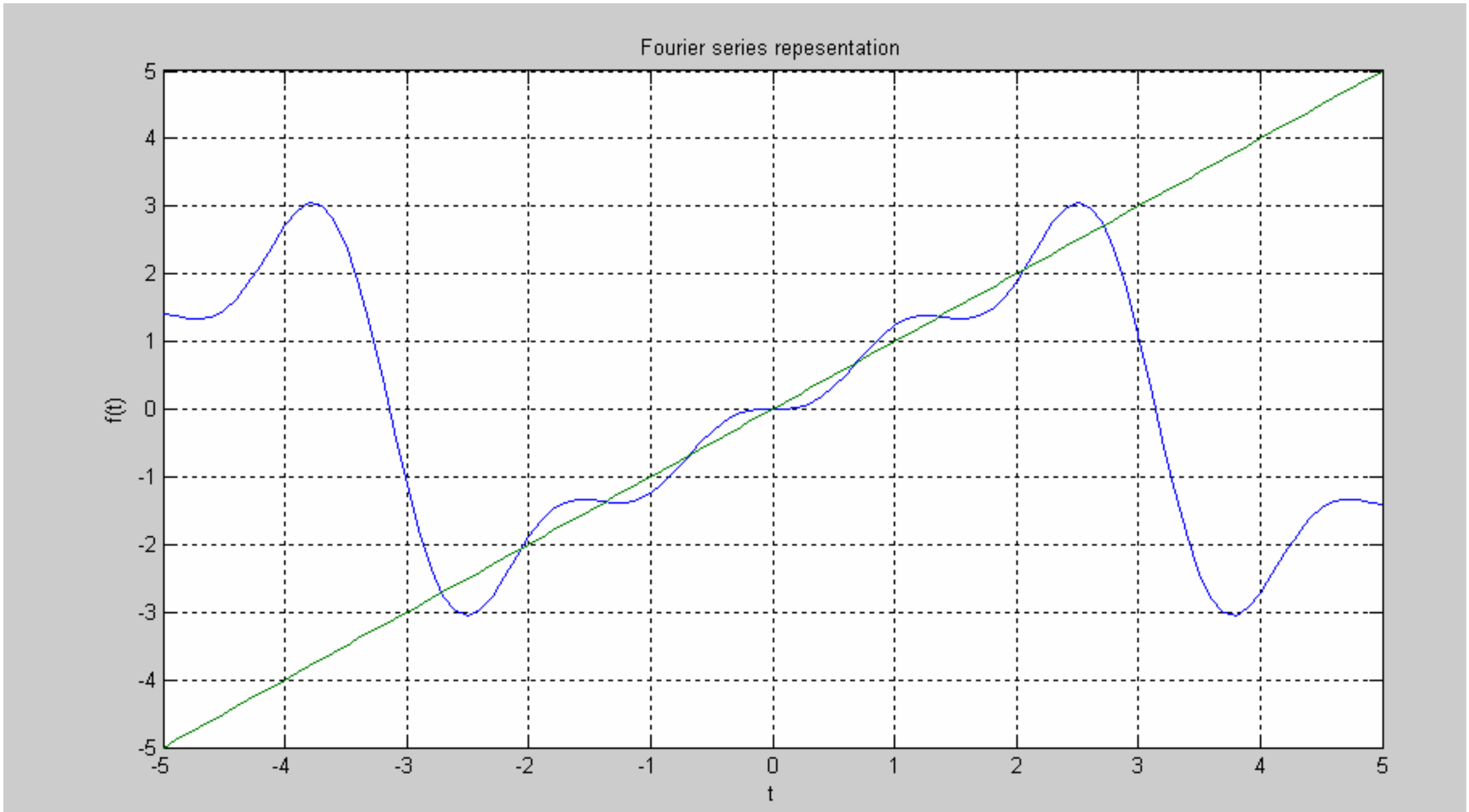
Shortcuts How to Add What's New

Command Window

```
>> t=-5:0.1:5;
>> A=0;
>> y=t;
>> for n=1:1:4
       g=2*(-1)^(n+1)/n
       h=sin(n*t)
       A=A+g*h
end
>> plot(t,A,t,y)
>> title('Fourier series repesentation');
>> xlabel('t');
>> ylabel('f(t)');
>> grid on
```


Fourier series repesentation
f(t)
t
5
4
3
2
1
0
-1
-2
-3
-4
-5
-5
-4
-3
-2
-1
0
1
2
3
4
5

Fourier series of square wave

- Equation

$$f(t) = \frac{4k}{\pi}(\sin t + \frac{1}{3}\sin 3t + \frac{1}{5}\sin 5t + \frac{1}{7}\sin 7t + ...)$$

- General formula

$$f(t) = \frac{4k}{\pi}\sum_{n=1}^{\infty}\frac{1}{n}\sin(nt)$$

- Conditions
  - **$-\pi < t < \pi$**
  - **n = 45 (2n=0, 2n-1=n)**
  - **k = 2**

Command ‘for’

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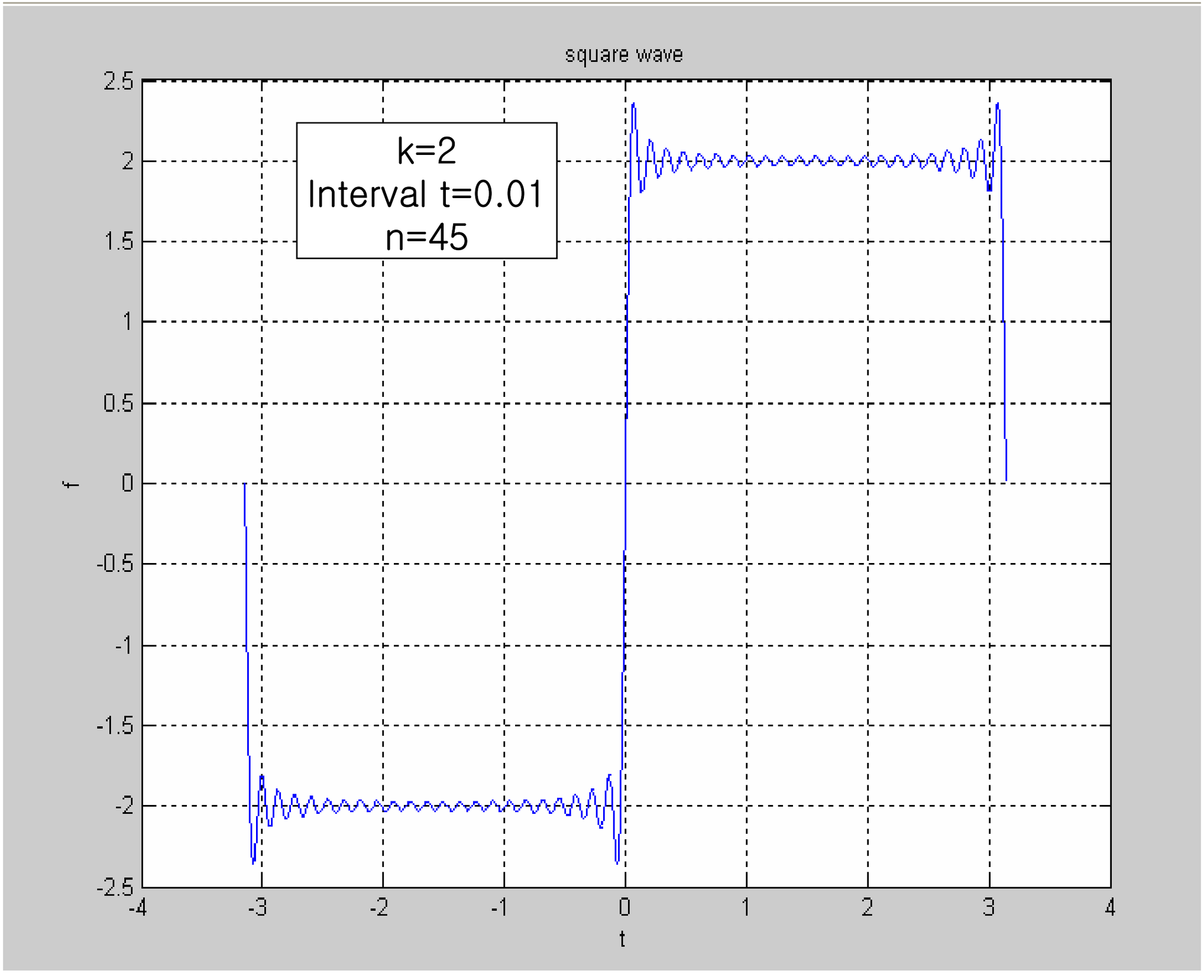
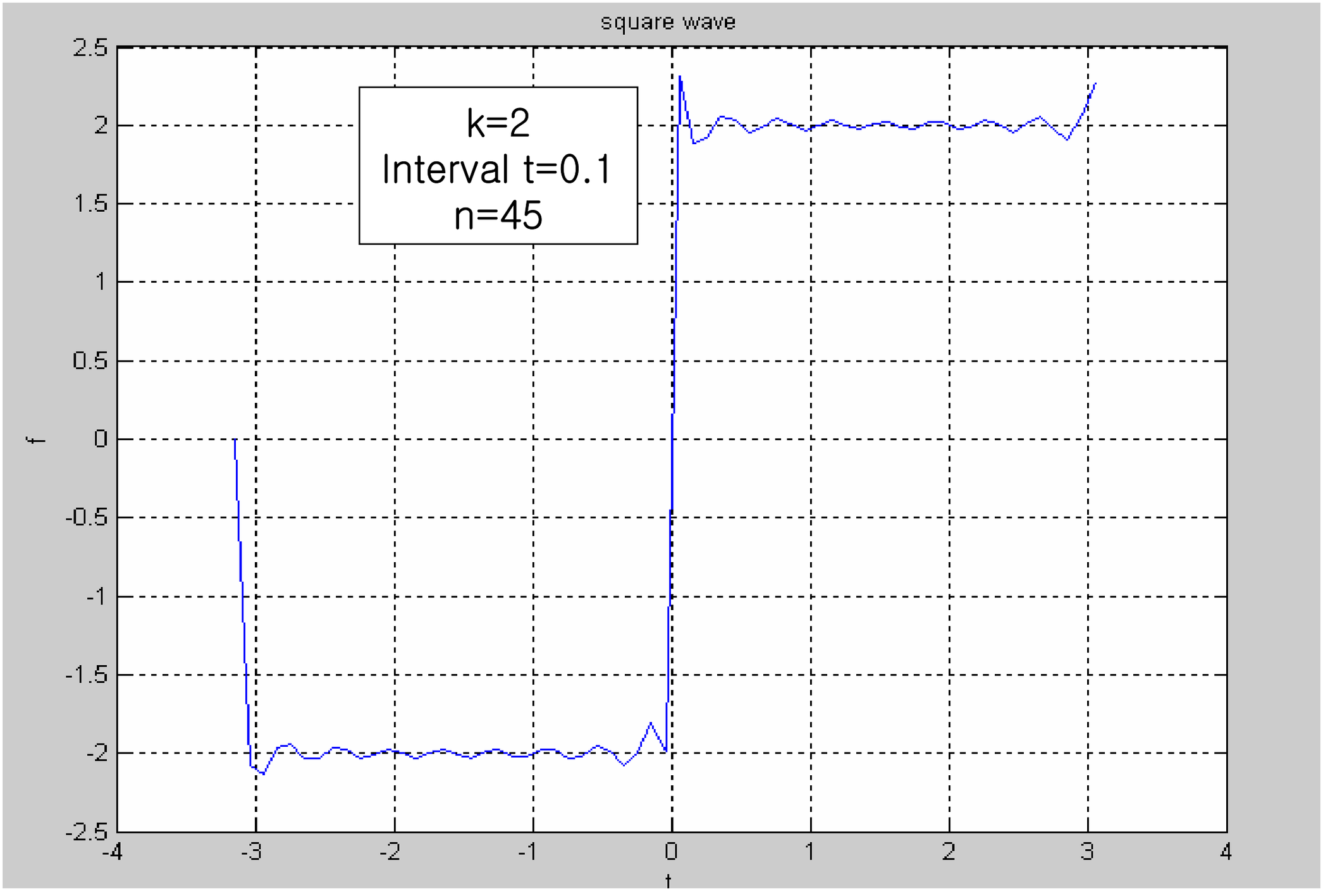
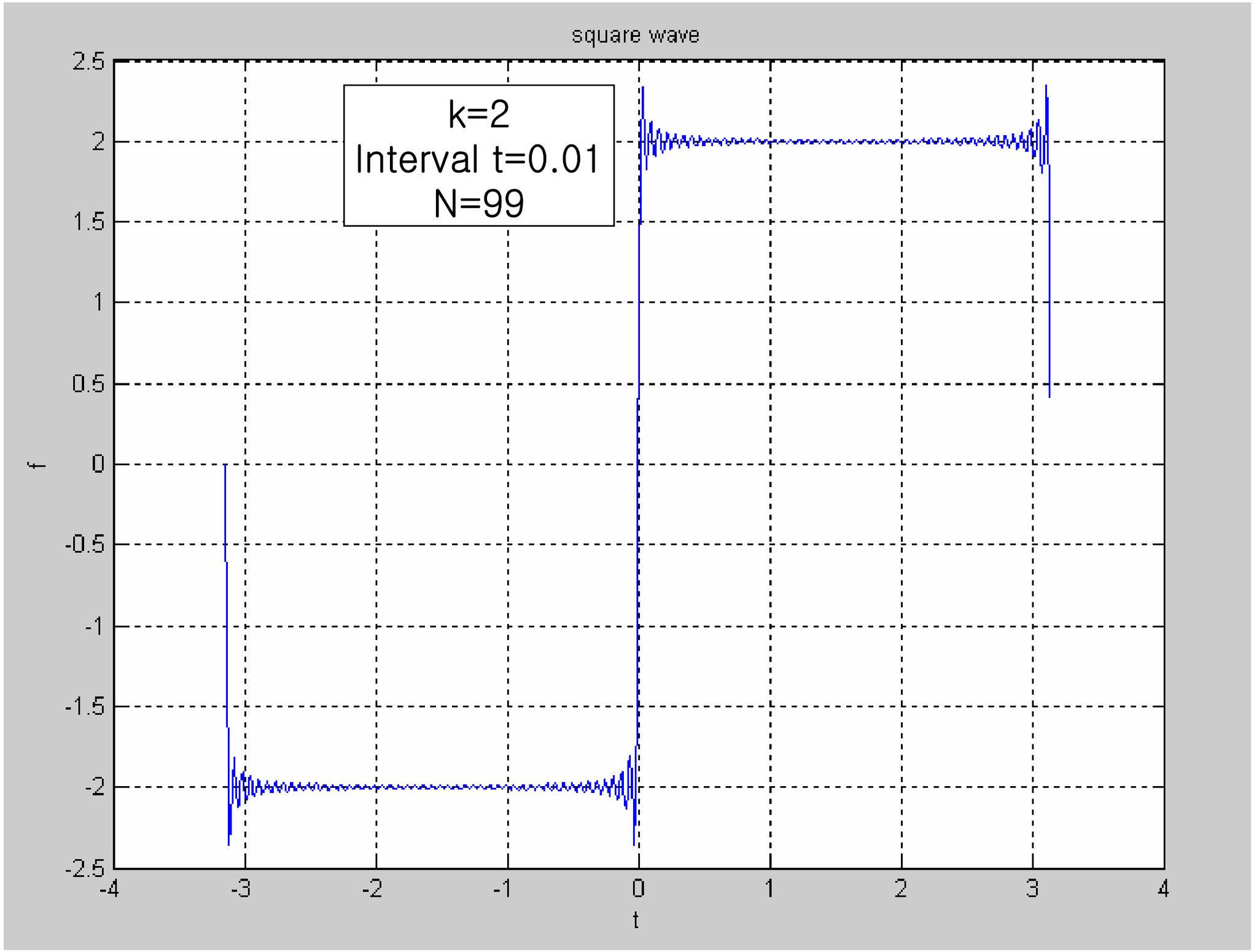
Stack: Base

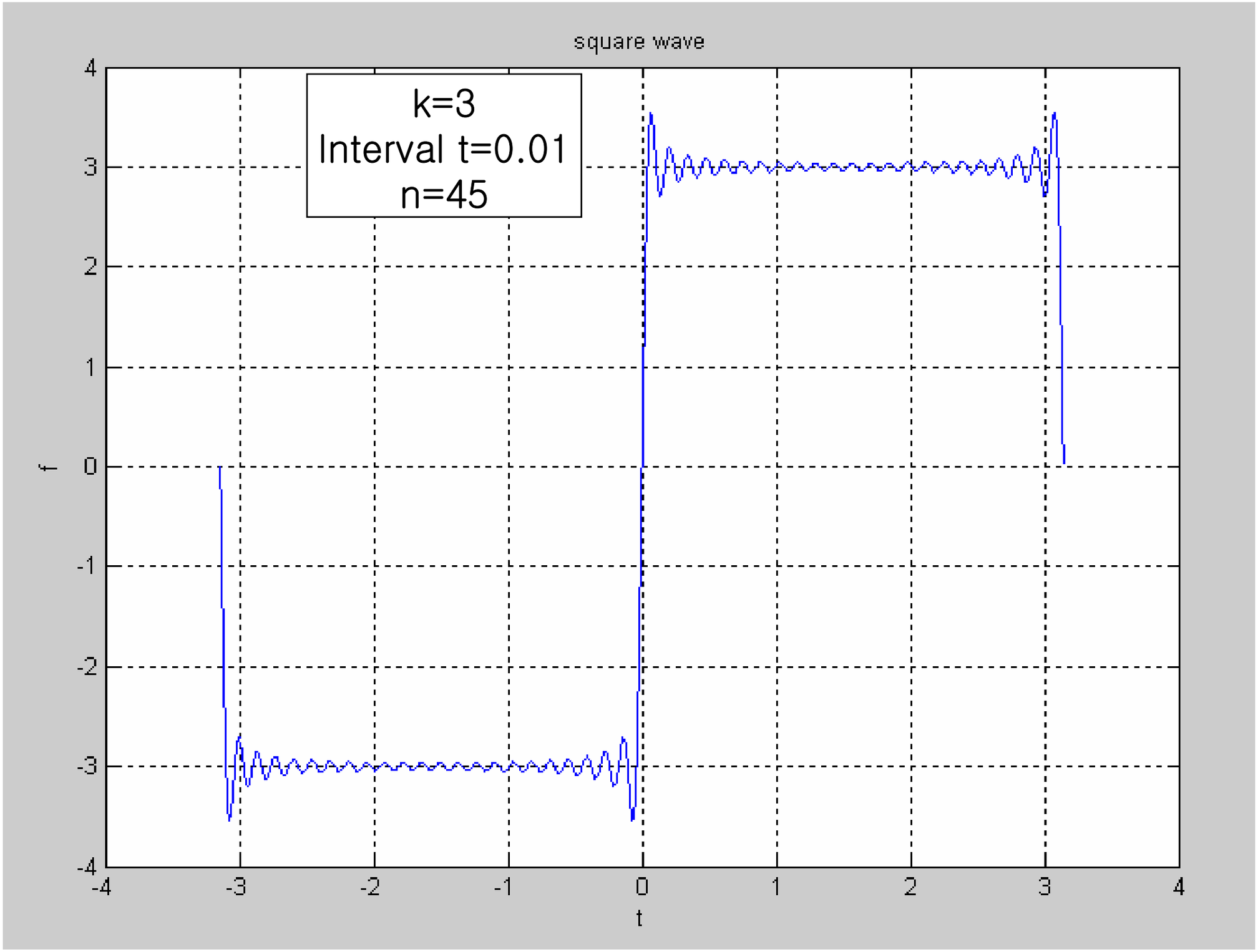
```
1 -   t=-pi:0.001:pi
2 -   A=0
3 -   k=2
4 -   for n=1:2:45
5 -       A=A+(4*k/(n*pi)*sin(n*t))
6 -   end
7 -   plot(t,A);
8 -   grid on;
9 -   xlabel('t');
10 -  ylabel('f');
11 -  title('square wave');
```

script Ln 8 Col 9 OVR


square wave
k=2
Interval t=0.01
n=45
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
f
-4
-3
-2
-1
0
1
2
3
4
t


square wave
k=2
Interval t=0.1
n=45
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-4
-3
-2
-1
0
1
2
3
4
t


square wave
k=2
Interval t=0.01
N=99
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
f
-4
-3
-2
-1
0
1
2
3
4
t


square wave
k=3
Interval t=0.01
n=45
4
3
2
1
0
-1
-2
-3
-4
-4
-3
-2
-1
0
1
2
3
4
t