

# Calculating Simple Harmonic Oscillation

Enter period, amplitude and time to calculate displacement at specified time, acceleration, angular velocity, and velocity. Also, display the changes during the entered time period on a graph.

## Calculation

$$\text{angular velocity : } \omega = \frac{2\pi}{T}$$

$$\text{displacement : } x = A \times \sin(\omega t)$$

$$\text{acceleration : } a = -\omega^2 \times x$$

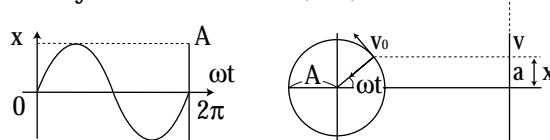
$$\text{velocity : } v = A \times \omega \times \cos(\omega t)$$

A : amplitude

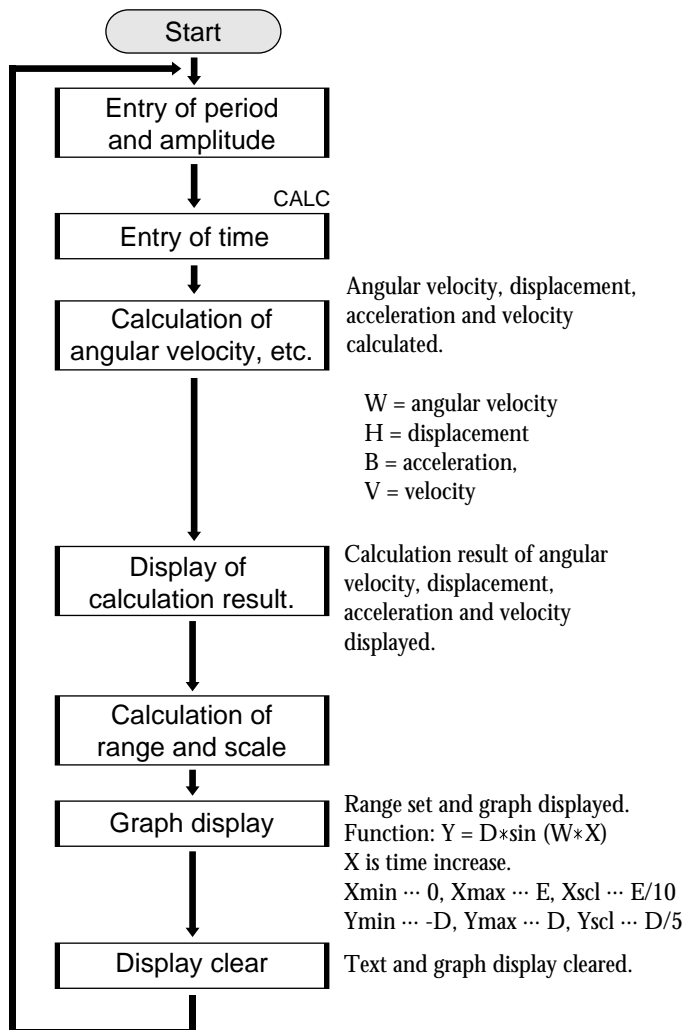
t : time [sec]

T : period [sec]

$\omega$ : angular velocity [rad/sec]



## FLOWCHART



## PROGRAMME LIST (REAL MODE)

Title : OSCILLAT

```

Rad
Print "Input PERIOD
Input P
P ÷ F
Print "Input AMPLITUDE
Input A
A ÷ D
Label CALC
Print "Input TIME
Input T
T ÷ E
2 * π / F ÷ W
D * sin (W * E) ÷ H
-(W²) * H ÷ B
D * W * cos (W * E) ÷ V
Print "ANGULAR VELOCITY
Print W
Print "MAGNITUDE
Print H
Print "ACCELERATION
Print B
Print "VELOCITY
Print V
Wait
E / 10 ÷ X scl
D / 5 ÷ Y scl
0 ÷ Xmin : E ÷ Xmax
-D ÷ Ymin : D ÷ Ymax
Draw D * sin (W * X)
Wait
ClrT
ClrG
Goto CALC
  
```

**PARAMETERS**

| Name of parameter | Content                        | Name of parameter | Content            |
|-------------------|--------------------------------|-------------------|--------------------|
| B                 | acceleration                   | A                 | input of amplitude |
| E                 | time                           | P                 | input of period    |
| V                 | velocity                       | T                 | input of time      |
| W                 | angle of velocity ( $\omega$ ) | D                 | amplitude          |
| H                 | displacement                   | F                 | period             |
| Xscl              | x-axis scale                   | X                 | time increase      |
| Yscl              | y-axis scale                   |                   |                    |

**Exercise**

Calculate angular velocity, etc., using period  $\pi$ , amplitude 1 and time 3 seconds and display the changes on a graph.

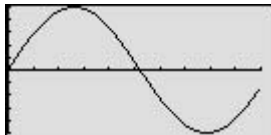
Set up condition: decimal point in Float Pt Mode.

**2nd F** **SET UP** **C** **1** **E** **1** **CL**

**Step**

**Key Operation**

**Display**

- |          |  |  |  |
|----------|--|--|--|
| <b>1</b> | Specify the programme mode.<br>Select the title OSCILLAT.  | <b>PRGM</b> <b>A</b>   | <pre>OSCILLAT Input PERIOD P=?</pre>   |
| <b>2</b> | Enter the values of period, amplitude, and time.   | <b>2nd F</b> <b><math>\pi</math></b> <b>ENTER</b> <b>1</b> <b>ENTER</b> <b>3</b> | <pre>OSCILLAT Input PERIOD P=<math>\pi</math> Input AMPLITUDE A=1 Input TIME T=3</pre>             |
| <b>3</b> | (Display of angular velocity)<br>(Display of displacement)<br>(Display of acceleration)<br>(Display of velocity) | <b>ENTER</b>   | <pre>ANGULAR VELOCITY 2 MAGNITUDE -0.279415498 ACCELERATION 1.117661993 VEROCITY 1.920340573</pre> |
| <b>4</b> | (Display of graph of simple harmonic oscillation)  | <b>ENTER</b>   |               |
| <b>5</b> |  | <b>ENTER</b>   | <pre>Input TIME T=?</pre>  |