

# To teach waves, using spreadsheet software

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## ■ Summary

To help the students learn the characteristics of waves: Simple oscillation, sine waves, traveling waves, standing waves, etc.

## ■ Objectives

In the classes about waves, we often conduct experiments to teach students how the wave progresses. However it is difficult for students to confirm the characteristics of each wave, as waves created by a wave machine travel fast on the surface of water. It is easy to make them understand the characteristics of waves by using the graphic capabilities of spreadsheet software and VBA animations.

## ■ Key Benefit

As you can stop the movement of progressing waves on an animation graph, it is possible to teach the major points of study for that particular moment.

## ■ Prerequisite Skills

As it is a study material used for presentation, it is all right as long as the teacher knows how to open and close the spreadsheet software.

**What's waves?**

The central graphic is a large, blue, 3D-style oval containing the text "What's waves?". Surrounding this central text are several smaller screenshots of spreadsheet software windows, each with a title and a graph or animation. The screenshots include:

- Superposition of waves**: A spreadsheet window showing two overlapping sine waves on a graph.
- Wave pattern in a graph**: A spreadsheet window showing a single sine wave on a graph.
- Sine wave**: A spreadsheet window showing a sine wave on a graph.
- Standing wave**: A spreadsheet window showing a standing wave on a graph.
- Reflection**: A spreadsheet window showing a wave reflecting off a boundary.
- Longitudinal wave / Transverse wave**: A spreadsheet window showing a longitudinal wave and a transverse wave on a graph.
- Interference of waves**: A 3D visualization of spherical waves spreading out from a central point.
- Simple oscillation and sine wave**: A spreadsheet window showing a sine wave on a graph.

To the right of the central graphic is a stick figure surfing on a blue wave. Below the central graphic is a text box titled "Use of this material".

## ■ Use of this material

I used this material in the classes when I was a high school teacher 5 years ago. I developed it as a teaching material to give a presentation to many students at one time. Although I have not made it available for public use, taking this opportunity, I will put it on the database server in the educational network of prefectural schools so that it can be used anytime.

## ■ Background of creation of this study material

A number of freeware products are made available over the Internet. However, I created this study material by myself in order to achieve the movements and expressions I intended to show. I knew that it was possible to create the material with VisualBasic, but I thought that it could be made easily by combining spreadsheet software and VBA, as the latter is very useful for mathematical calculations. As graphs can be created with ease with Excel, I was swiftly able to create the material.