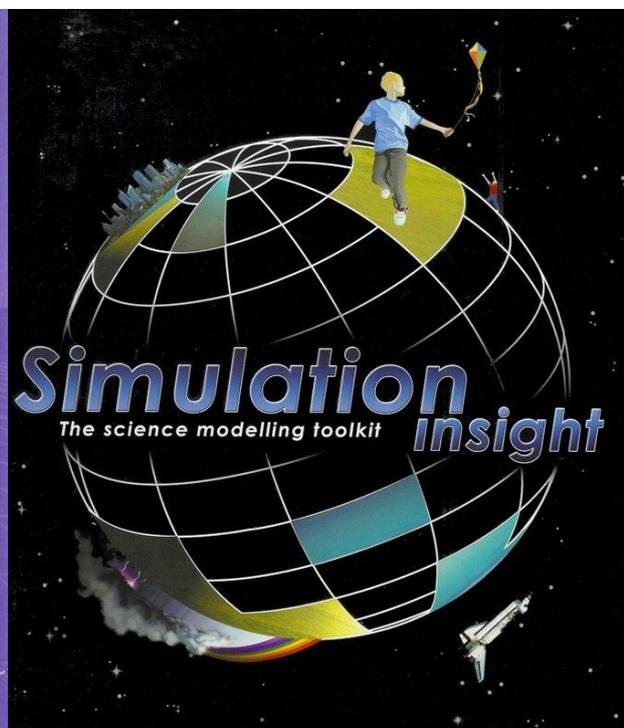
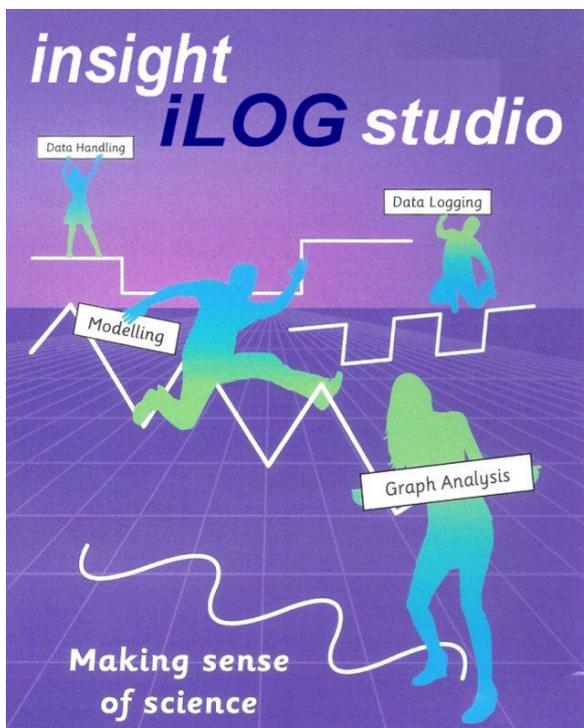


# Introduction to Insight software



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# A. Insight ●●

This introductory module presents short descriptions of the **Insight** software suite and activities for learning basic features of the program.

The simple step-by-step tutorials are meant for teachers and are related to the topic of **oscillations**.

The Insight software suite for science and technology education has been developed by Dr. Laurence Rogers at the University of Leicester, England and is published by Insight Resources<sup>1</sup>.

The main components are:

- *Insight iLOG Studio* (and *Insight iLOG Junior*) for measurement and analysis
- *Control Insight* (and *Junior Control Insight*) for control technology
- *Simulation Insight* (and *Junior Simulation Insight*) for simulation and modelling.

Most of the activities prepared by the IT for US Project may be performed using *Insight iLOG Studio* and *Simulation Insight*. These programs offer the integration of data-logging, simulation and modelling activities through a common user interface built around a versatile graphing facility incorporating a suite of tools for analysing data.

## Measurement Activities (Data-logging)

Measurement of physical quantities using a computer requires electrical sensors and an interface or data-logger. *Insight iLOG Studio* supports the use of a range of different hardware systems including the CoachLab II/II<sup>+</sup> interface<sup>2</sup> and the LogIT range<sup>3</sup> of data-loggers.

Data-logging experiments require three main aspects of preparation:

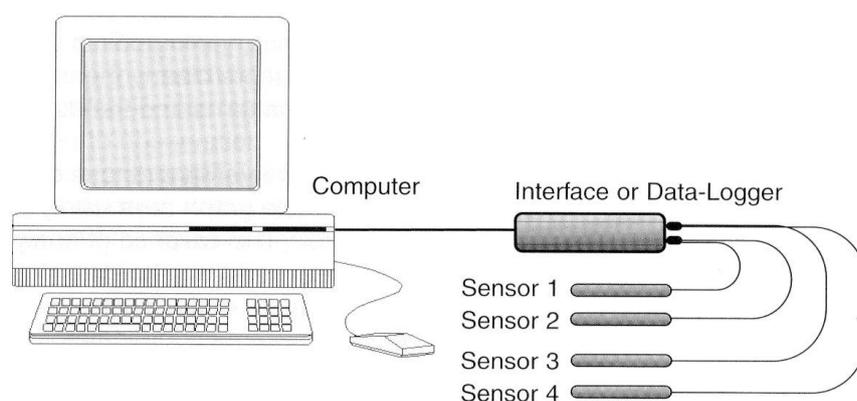
- Apparatus for the experiment
- Connection of sensors, interface and computer
- Configuration of the software.

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<sup>1</sup> Insight Resources, Coalville, England. [www.insightresources.co.uk](http://www.insightresources.co.uk)

<sup>2</sup> CMA, Amsterdam, Netherlands [www.cma.science.uva.nl](http://www.cma.science.uva.nl)

<sup>3</sup> DCP Microdevelopments Ltd., Great Ellingham, England. [www.dcpmicro.com](http://www.dcpmicro.com)



*Insight iLOG Studio* contains built-in wizards and videos explaining how to prepare and use each aspect:

- Select *Welcome* on the Control panel menu.

Configuration of the software involves identifying sensors, setting the parameters for the graph and organising the screen layout. Hardware systems usually automatically recognise sensors and calibrate the software accordingly. The simplest way of preparing the software for an experiment is to open a 'set up' file which restores all the necessary settings which have been previously saved. Thus, in one action, the program can be configured ready for a particular experiment. If you need to configure the program manually, please consult the guidance in the *Insight - Quick Help* notes, accompanying this module.

It is a wise practice to make a trial run with the apparatus and software to test that everything is working before the main experiment.

- Click on the prominent green START button to begin logging.

When data have been collected, scientific investigation may begin. (See Activity 1.) Data are most easily viewed and analysed in the main graph window. Cursors are available for taking readings, measuring changes, rates of change, gradients, areas and ratios. The axes may be reassigned, scales may be stretched, squeezed or zoomed, and best fit curves may be plotted. For guidance on using these facilities, please consult the *Insight - Quick Help* notes.

*Insight iLOG Studio* also includes a window for creating models. Data from models may be compared directly with data obtained from experiments.

## Simulation Activities

*Insight iLOG Studio* can exchange data with its companion program *Simulation Insight*. The purpose of *Simulation Insight* is to facilitate virtual experiments imitating real experiments with sensors, but offering a much wider range of control over the parameters and conditions in an experiment. The animated images in the program provide valuable visual aids which can help to understand a phenomenon. (See Activity 2.)

Simulations can generate data which can be analysed using similar techniques to those with data-logging data. The graph window is the key tool for analysis, and its comprehensive facilities are identical to those in *Insight iLOG Studio*.

## Modelling Activities

Both *Insight iLOG Studio* and *Simulation Insight* contain a modelling window in which mathematical models may be built, tested and analysed.

In *Simulation Insight* all the control, displays and animations are linked to variables in the model. The model may be inspected at any stage and may be modified to alter or improve the accuracy of the simulation. The main virtue of having access to the model for the simulation is that it shows all the variables involved in the simulation and the relationships between them. A complex system may be analysed into recognisable elements representing simple scientific concepts and principles. In the modelling window, each variable is shown in its own box, and links between them show how variables depend upon each other. (See Activity 3.) When the model is running, each box displays the numerical value for its variable.

# B. Student Activities ●●

## ACTIVITY 1. INTRODUCTION TO INSIGHT ILOG STUDIO – SWINGING PENDULUM

### Learning Objectives:

1. To learn how to make physical measurements in *Insight iLOG Studio*
2. Analyse the pendulum's motion

### Materials:

- *Insight iLOG Studio* software
- *Insight* Set-up file: 'pendulum set up'
- Data-logger or interface
- Angle sensor in clamp
- Pendulum consisting of stiff wire and metal mass
- [Optional: *Insight* file: 'pendulum data']

### Activity method:

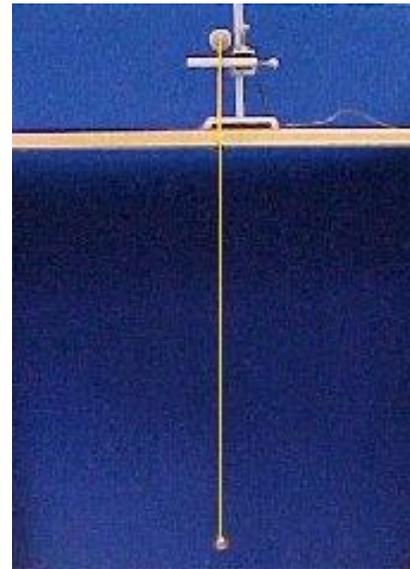
In this activity you will analyse the motion of a simple gravity pendulum. The pendulum is one of the simplest mechanical oscillating systems and consists of a mass attached to a wire, which, when given an initial push, will swing back and forth under the influence of gravity. This example is used to teach you how to observe oscillations as *angle vs time* graphs. The software allows you to take measurements from the graph, such as time intervals, velocity and acceleration.

### Starting Insight:

1. Start *Insight iLOG Studio* and select 'Insight Laboratory' on the Help menu.
2. Select the Experiment 'Pendulum motion' and follow the instructions which are summarised below.
3. See the *Quick Help* notes for details on using *Insight iLOG Studio*.

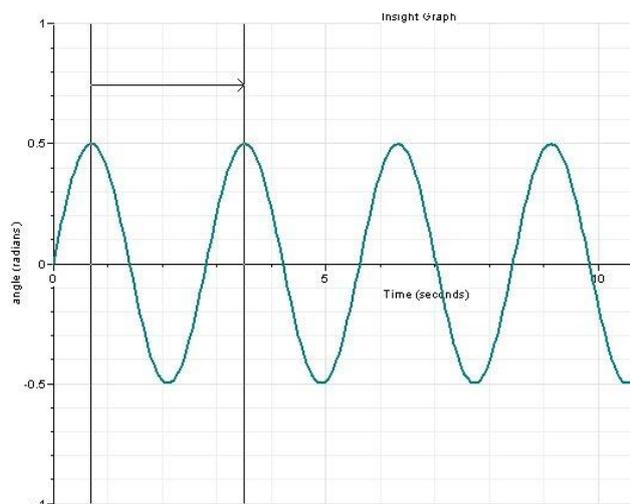
## Setting up the experiment:

1. Connect the data-logger to the computer.
2. Assemble the pendulum as shown and connect the sensor to the data-logger.
3. Start *Insight iLOG Studio* and open the file 'pendulum set up'.
4. Allow the pendulum to hang vertically and click START in the program.
5. Adjust the angle sensor (rotate it in the clamp) until the graph shows a reading of zero, along the Time axis.

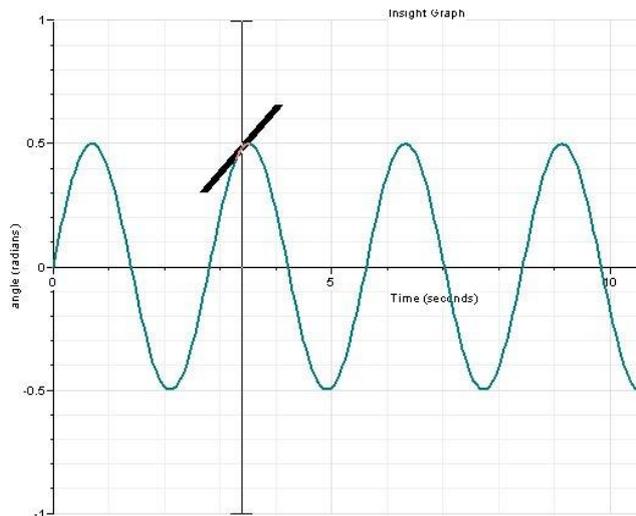


## Measuring:

1. Set the pendulum swinging and click START. Observe the graph.
2. Select 'Readings' from the Analyse menu and when the cursor appears, slowly move it from left to right. The bar display helps to remind you about the motion of the pendulum. Think about the connection between the peaks and the swings of the pendulum.
3. Select 'Interval' on the Analyse menu. You can use the cursors to measure the time between two peaks on the graph as follows:
4. Move the cursor until it lines up with a peak, then double click.
5. Move the second cursor to line up with the next peak. The time interval between the peaks shows up on the Control Panel.
6. Repeat this measurement between different sets of peaks. What conclusions can you draw?
7. Repeat the whole experiment with a smaller angle of swing at the start. What conclusion can you draw from the results?



8. Select 'Gradient' from the Analyse menu and when the cursor appears, RIGHT click on the graph to show the steepness of the graph line. The steepness at each point represents the instantaneous angular velocity of the pendulum and the value shows on the Control Panel. Find out the places on the graph for maximum velocity and zero velocity. Relate these to the swings of the pendulum.



### Optional demonstration:

For demonstration purposes, all of the above measurement activities may be performed by first loading the *Insight* file 'pendulum data'.

## ACTIVITY 2. INVESTIGATING A SWINGING PENDULUM SIMULATION

### Learning Objectives:

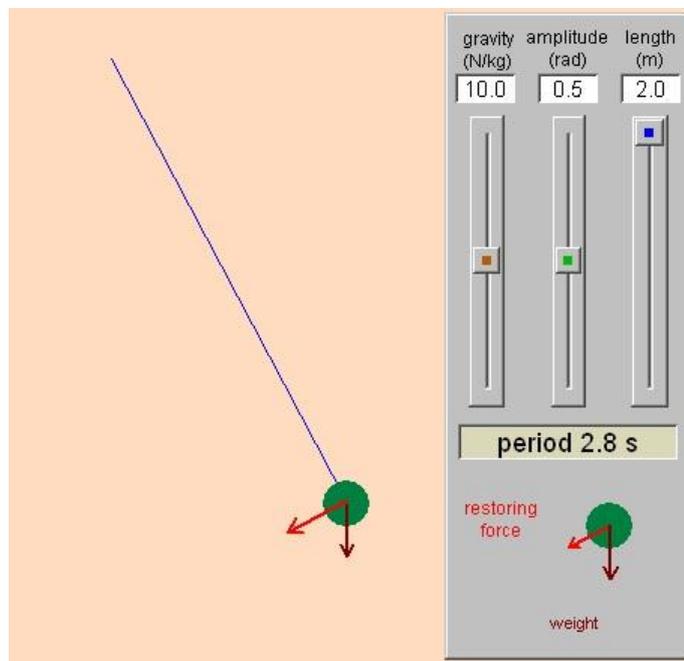
1. To learn how to use *Simulation Insight* as a tool for investigating a simulated experiment
2. Analyse the effect of several variables on the motion of a pendulum

### Starting Insight:

1. Start *Simulation Insight* and open the file 'pendulum'.
2. See the *Quick Help* notes for details on using *Simulation Insight*.

### Observing motion and inferring forces:

1. When you open the file, observe the pendulum motion. Notice the changes to the restoring force on the bob during each swing.
2. What is the connection between the restoring force and the displacement angle at each stage of the swing?
3. Vary the amplitude of swing and note its effect on the motion and period.



4. Observe the effect of altering the length of the pendulum. Find out how much the length must be change to make the period of swing half as much.
5. Vary the strength of gravity and notice its effect on the motion and period.

## Making measurements:

1. RIGHT click on the START button and set the Run properties to record data.
2. LEFT click on START to make the pendulum swing and record data.
3. When the pendulum stops swinging, switch to the Graph window and observe the graph of angle and force against time.
4. Explain how the graph confirms your idea about the connection between the restoring force and displacement angle.
5. Perform the measurements of 'Readings', 'Interval' and 'Gradient' as you did for Activity 1 (Data-logging) and compare the results.

## ACTIVITY 3. INVESTIGATING A MODEL FOR A SWINGING PENDULUM

### Learning Objectives:

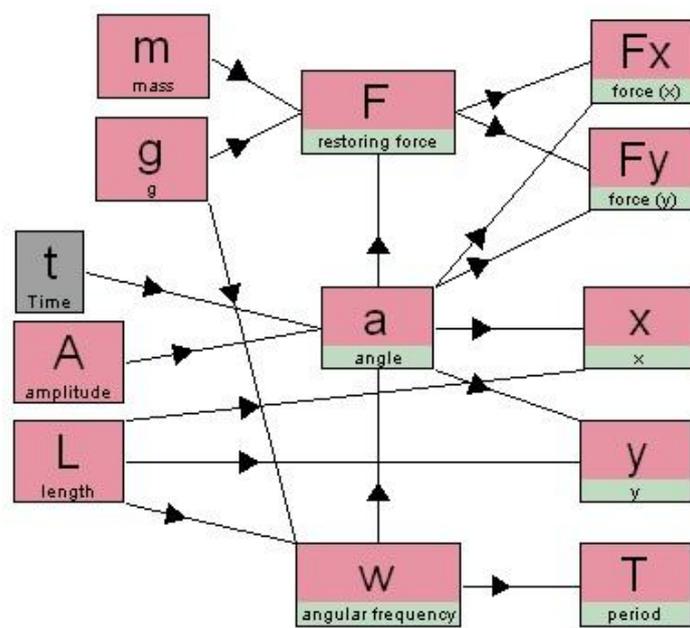
1. To learn how to use *Simulation Insight* as a tool for investigating a model which generates data for a simulation
2. Analyse the relationships between the variables which describe the motion of a pendulum

### Starting Insight:

1. Start *Simulation Insight* and open the file 'pendulum model'.
2. See the *Quick Help* notes for details on using *Simulation Insight*.

### Observing the model:

1. Hold down the SPACE bar on the keyboard. Observe the motion of the pendulum and the calculations performed by the model.
2. Release the SPACE bar and observe the model. The pink boxes show variables needed to describe the motion. The links between the variables show how variables depend upon each other. Boxes with a green stripe show variables that are calculated by the model. For each of these, the formula used for the calculation is displayed when you point to the variable using the mouse. A summary of all the formulae is shown in the Script window which can be selected from the View menu.



3. Try to understand the basis for each formula. Here are some explanations:

**$w = \sqrt{g/L}$**  Angular frequency **w** is  $2\pi$  times the number of oscillations per second; it depends upon the square root of **g** and **L**

**$x = L \cdot \sin(a)$**  **x** and **y** are the coordinates of the pendulum bob.  
 **$y = L \cdot \cos(a)$**

**$F = m \cdot g \cdot \sin(a)$**  Restoring force **F** is the component of gravity at right angles to the wire: it causes the acceleration of the bob along the arc of movement and always points towards the centre of the swing path.

**$F(x) = F \cdot \cos(a)$**  **F(x)** is the horizontal component of **F**

**$F(y) = F \cdot \sin(a)$**  **F(y)** is the vertical component of **F**

**$T = 2\pi / w$**  Period **T** is the time for one complete oscillation.

4. Now press the SPACE bar intermittently so that the model works one step at a time. Observe how each of the calculated variables is related to the motion:

**x** and **y** show the position of the bob

**F**, **F(x)** and **F(y)** determine the size and direction of the force vector  
**a** shows the angle of the wire.

5. Click on the pink box for mass, adjust the value of the mass and observe the effect on the forces and the period. (Hold the SPACE bar down to make the pendulum swing.)
6. Similarly adjust the amplitude **A** and note its effect on the period.
7. Adjust the length of the pendulum and observe its effect on all the other variables.