

Mechanical oscillations and waves

Recording mechanical oscillations

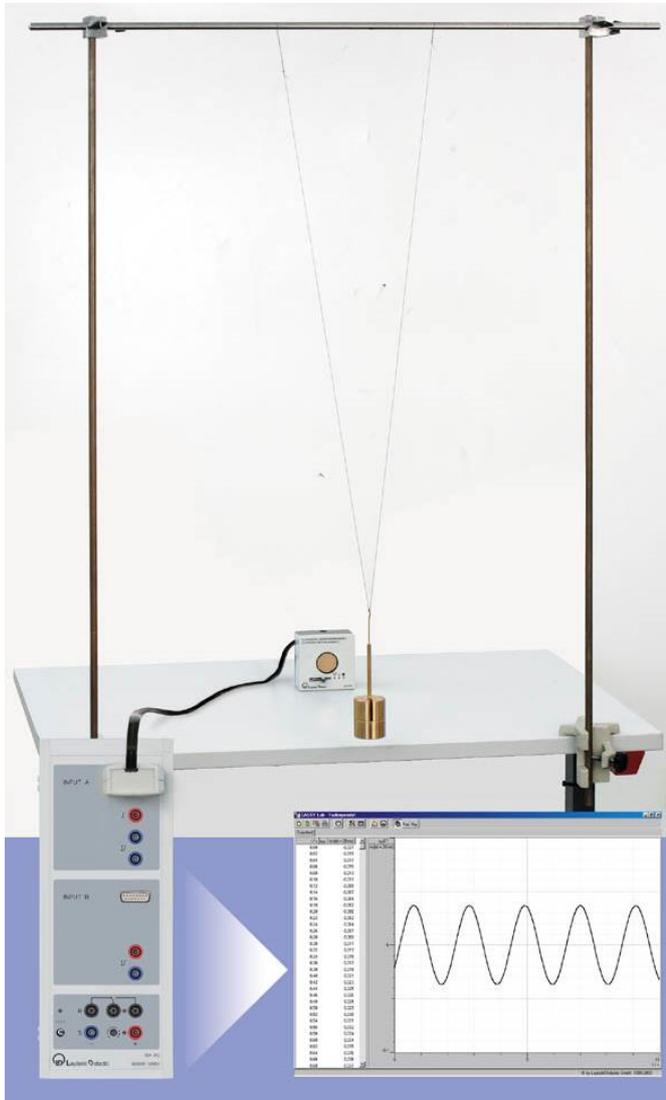
Recording the oscillation of a string pendulum

Sensor-CASSY and ultrasonic motion sensor S

Objects of the experiment

1. Record the oscillation of a string pendulum as a graph of distance against time.
2. Determine the amplitude and period of oscillation for a string pendulum.

Setup



Preparation of a pendulum suspended via two lengths of string:

- Cut off a length of string about 2 m long from the roll of fishing line.
- Tie a loop into both ends of the string.
- Move the loops of the string along the stand rod (300 44) and position them about 20 cm apart.
- Suspend the hanger for slotted weights at the bottom of the string.

Preparation of Sensor-CASSY:

- Connect the Sensor-CASSY module to a USB port of a computer.
- Run the CASSY-Lab software.
- Activate INPUT A of the CASSY module by clicking it with the left mouse button in the "Settings" window.
- Configure the following settings in the "Sensor input settings" window.

Measuring range: -1 m.....1 m

Measurement parameters: Narrow view

Zero point: Centre

Zero point →0←: Click with the left mouse button to establish the zero point as that of the pendulum in rest position.

- Configure the following settings in the "Measurement parameters" window. **Time for measurement:** 10 s
- Afterwards, close all windows to apply the settings.

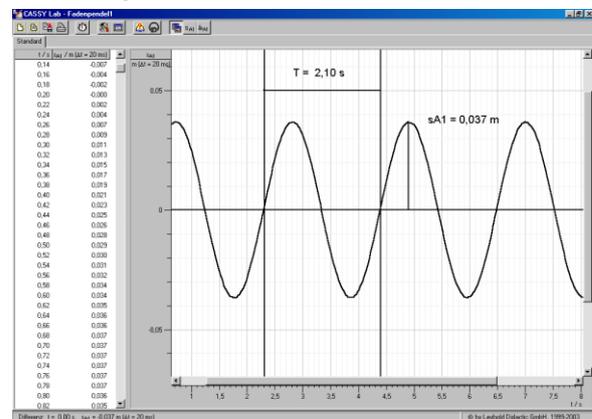
Apparatus

1 Slotted mass hanger, 50 g, large.....	315 450
1 Slotted weight, 500 g.....	315 460
1 Fishing line	309 48ET2
1 Sensor-CASSY 2	524 013
1 CASSY-Lab 2.....	524 220
1 Ultrasonic motion sensor S	524 070
2 Bench clamps	301 06
2 Stand rods, 150 cm, 12 mm diam.....	300 46
1 Stand rod, 100 cm, 12 mm diam.	300 44
2 Leybold multiclamps.....	301 01
Additionally required:	
1 PC with Windows XP SE or higher	

Procedure

- Position the ultrasonic motion sensor S about 40 cm from the string pendulum and align it to the height of the pendulum bob.
- Deflect the string pendulum.
- Start measuring by pressing the F9 key.
- Observe the curve on the screen.
- Determine the amplitude $sA1$ and period of oscillation T of the string pendulum from the curve.

Measuring example



Evaluation

Oscillation refers to motion of a body which repeats periodically over time and passes back and forth across the equilibrium position of the body.

The relationship between distance and time is described by a sine function.

The time for one complete motion back and forth across the equilibrium position is called the period.

The distance between the equilibrium position and the points where the motion reverses is called the amplitude.

The period of oscillation T of a body indicates how long a swinging body takes to complete one oscillation.

In the example experiment, the amplitude of the string pendulum $sA1 = 0.037$ m and the period of oscillation $T = 2.10$ s.

Note:

In order to demonstrate that the relationship between distance and time is described by a sine function, a "free fit" function can be carried out in CASSY-Lab.