Mechanics

Acoustics

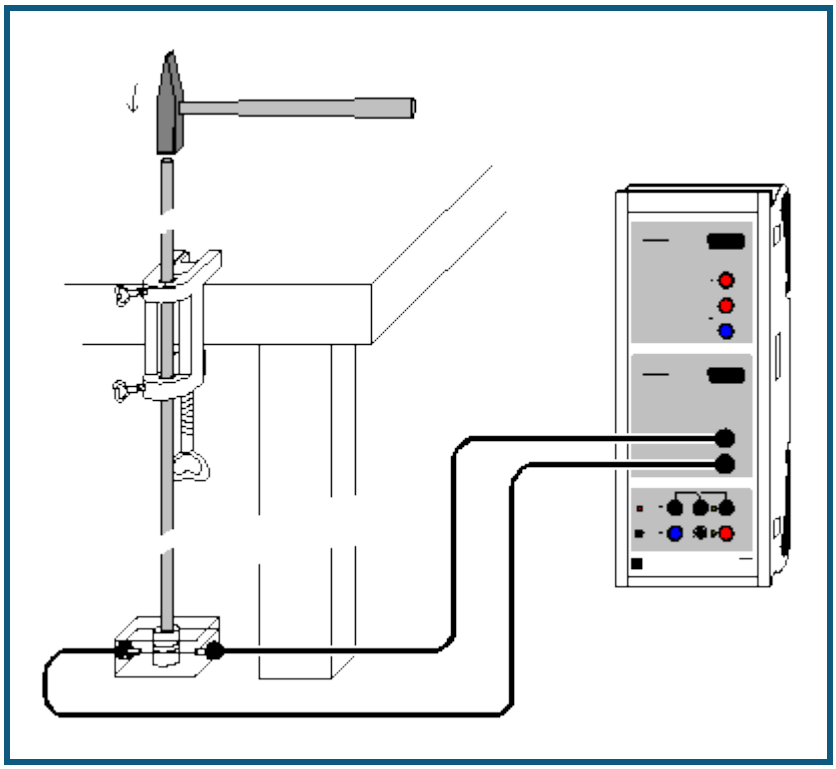
Wavelength and velocity of sound

Determining the velocity of sound in solids

Description from CASSY Lab 2

For loading examples and settings, please use the CASSY Lab 2 help.

Velocity of sound in solid bodies



can also be carried out with Micro-CASSY

Experiment description

The object of this experiment is to determine the velocity of sound in aluminum, copper, brass and steel rods. This measurement exploits the multiple reflections of a brief sound pulse at the rod ends. The pulse is initially generated by tapping the top end of the rod with a small hammer, and initially runs downward. The pulse is reflected several times in succession at the two ends of the rod, whereby the pulses arriving at one end are delayed with respect to each other by the time Δt. As Δt is the sum of the transit time out and back, we can calculate the velocity of sound c using the rod length s as

$c = 2s / \Delta t$.

Equipment list

1	Sensor-CASSY	524 010 or 524 013
1	CASSY Lab 2	524 220
1	Set of 3 metal rods	413 651
1	Stand rod, 150 cm	300 46
1	Piezoelectric body	587 25
1	Bench clamp, simple	301 07
2	Connecting leads, 2 m, black	501 38
1	Small hammer	
1	PC with Windows XP/Vista/7/8	

Experiment setup (see drawing)

The metal rods rest on the piezoelectric body, which converts the pressure oscillations of the sound pulses into electrical oscillations. These are recorded at input B of Sensor-CASSY.

Carrying out the experiment

Load settings

- Start the measurement with (software waits for the trigger signal).
- Tap the top end of the first metal rod with the small hammer (to generate the trigger signal).
- Repeat the experiment with a different metal rod, or delete a faulty measurement with Measurement → Delete Current Measurement Series.

Evaluation

You can determine the time differences Δt of the minima or maxima e.g. using 230113853vertical lines, finding the peak centers or by measuring the difference directly. As Δt is the sum of the transit time out and back, we can calculate the velocity of sound c using the rod length s as

$c = 2s / \Delta t$.

This example gives us the following sound velocity values:

Metal	Measurement	Literature value
Brass	3530 m/s	3500 m/s
Copper	3900 m/s	3800 m/s
Aluminum	5000 m/s	5110 m/s
Steel	5170 m/s	5100 m/s