**Exercise 101: SPEED OF SOUND**

Keywords: mechanical waves (longitudinal, transverse); harmonic motion; phase; Lissajous figures.

The exercise aims at determining the speed of sound in the air. The experimental setup is a wave generator connected to a speaker as well as a microphone (at a regulated distance from the speaker) used to receive the signal.

Measurements:

1. Set the desired frequency (according to the instructions given in class).
2. Manipulate the settings of the oscilloscope to get a clear reading from the screen.
3. For a given frequency systematically move the microphone with respect to the speaker to find distances at which the Lissajous figure is a line characterised by **the same slope coefficient**.
4. Repeat the measurements for the range of frequencies as instructed in class.

Report:

1. Calculate the average microphone-speaker distance for each frequency and determine the wave length.
2. For each wave length (frequency) calculate the speed of sound with the simple relation: $V = \lambda \cdot f$ where $\lambda$ is the wave length and $f$ is the frequency.
3. Calculate the average speed of sound.
4. Calculate a theoretical value of the speed of sound in the air: $V = \sqrt{\frac{\kappa \cdot R \cdot T}{\mu}}$ where:
   - $\kappa$ – specific heats ratio (assume the value of 1.4);
   - $R$ – ideal gas constant;
   - $T$ – temperature;
   - $\mu$ – molar mass.
5. Summarise the results and discuss possible errors.