Mechanics
Acoustics
Fourier analysis

Fourier analysis of sounds

Description from CASSY Lab 2
For loading examples and settings, please use the CASSY Lab 2 help.
Sound analysis

Experiment description

The object of this experiment is the analysis of sounds having different tones and pitches (e.g. sounds of the human voice or of musical instruments) by means of Fourier analysis. The resulting frequency spectrum shows the fundamental frequency $f_0$ and the harmonics.

The various vowels of a language differ mainly in the amplitudes of their harmonics. The fundamental frequency $f_0$ depends on the pitch of the voice. This is approx. 200 Hz for high-pitched voices and approx. 80 Hz for low-pitched voices. The vocal tone is determined by variations in the excitation of the harmonics. The same applies for the tone of musical instruments.

Equipment list

1 Sensor-CASSY 524 010 or 524 013
1 CASSY Lab 2 524 220
1 Multi-purpose microphone 586 26 with Base 300 11 or
1 Microphone S 524 059
1 PC with Windows XP/Vista/7/8

Experiment setup (see drawing)

Connect the multipurpose microphone to input A of Sensor-CASSY (don’t forget to set the microphone to “Signal” mode and switch it on).

Carrying out the experiment

- Load settings
- Start the measurement with.
- Select the Standard display and optimize the signal strength using the control on the microphone.
- Record and compare different sounds (Standard shows the signal form and Frequency Spectrum shows the Fourier analysis).
• To stop the measurement, deactivate Repeating Measurement in the Measuring Parameters window or press immediately after the end of a recording.

• To compare different frequency spectra, select Measurement → Append New Measurement Series and restart the measurement with Ø.

Evaluation

The fundamental frequency and each harmonic can be determined easily in the Frequency Spectrum (click with the mouse) using the coordinate display or by finding the peak centers. The amplitudes of the harmonics determine the tone of the recorded sound.

As the human ear perceives sound intensities in a logarithmic fashion, the logarithmic display of the frequency spectrum is better suited to the sensitivity of the human ear than a linear representation. Select the logarithmic representation by clicking on the y-axis of the frequency spectrum with the right mouse button (increase the lower limit, e.g. to −3).