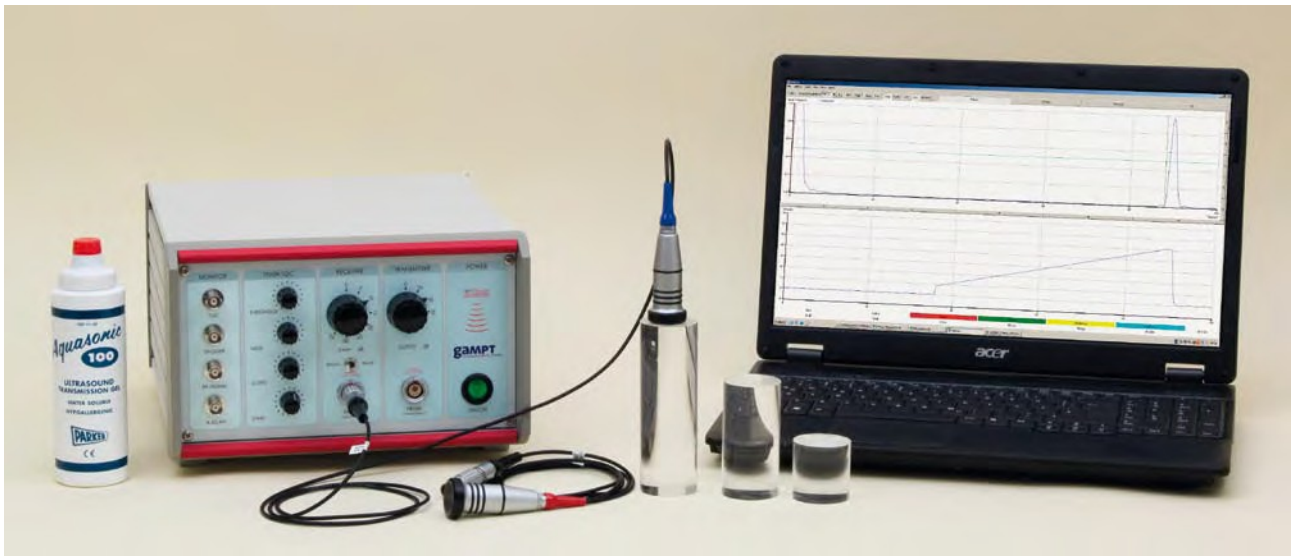
PHY02 Sound velocity in solids

In the experiment, the longitudinal sound velocity in acrylic is to be examined and determined at two different sound frequencies. For this purpose, time of flight measurements are carried out according to the pulse echo method (ultrasonic A-Scan) at three acrylic cylinders of different lengths.



Related topics

Propagation of ultrasonic waves, characteristic acoustic impedance, reflection, time of flight, sound velocity, pulse echo method, ultrasonic A-Scan

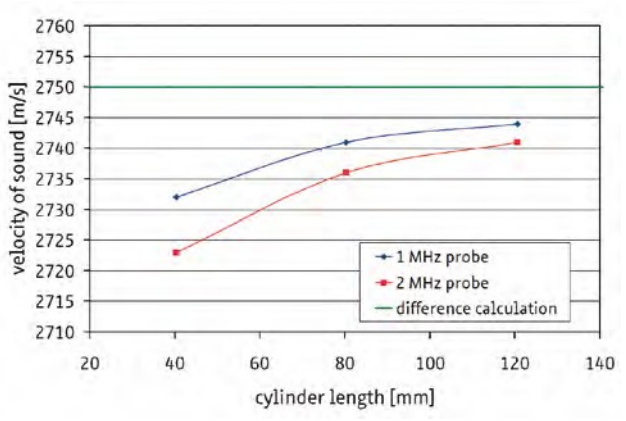
Ultrasonic waves propagate in a medium with a material-dependent velocity, which can be frequency-dependent. In gases and liquids sound propagation only takes place in the form of longitudinal waves. In solids, on the other hand, due to their elastic properties, shear waves can also occur. Shear and longitudinal waves generally propagate at different velocity. The sound velocity of the longitudinal waves generated in a solid with perpendicular sound coupling can be simply determined by means of time of flight measurements using the pulse echo method. By using samples of different lengths and sound probes with different frequencies, the intention in the experiment is to make statements on the frequency dependence of the sound propagation and on sources of errors caused by the structure of the ultrasonic probes that are used.

Equipment

Ultrasonic echoscope GS200	10400
Ultrasonic probe 1 MHz	10151
Ultrasonic probe 2 MHz	10152
Test cylinder set	10207
Ultrasonicgel	70200

Results

The sound velocities calculated from the times of flight measured show a systematic error, the influence of which becomes smaller as the measuring length is increased, and which is caused by the time of flight also measured in the protection/adaption layer of the probes. In this case, the 2 MHz probe possesses a thicker protection/adaption layer so that the sound velocities determined with it show a greater error. Using a difference calculation from two measurements with different sample lengths, this error can be eliminated (green line in the graphic, c_L = 2750 m/s, same values for both frequencies, no dispersion).



Related experiments

PHY07 Shear waves in solids
IND01 Non-Destructive Testing (NDT)
IND06 Angle beam testing
MED04 Biometry at the eye phantom