

PHY23 Dispersion of ultrasonic waves (Lamb waves)

In the experiment, the phenomenon of formation and propagation of guided ultrasonic waves (Lamb waves) is investigated. The frequency-dependent velocity (dispersion) of Lamb waves in thin glass plates is measured. The Lamb waves are stimulated and determined by means of angle beam probes.



Related topics

Longitudinal waves, shear waves, Lamb waves, wave modes, phase velocity, group velocity, dispersion, law of refraction

The phenomenon of Lamb waves causes by superimposing of ultrasonic transverse and shear waves in thin plates, whose thickness is smaller than the ultrasonic wave length. What is interesting about lamb waves is that they, on the one hand, show a frequency-dependent change of their propagation velocity (dispersion). On the other hand, lamb waves are present in the form of symmetrical and anti-symmetrical modes which propagate within the material independent of each other.

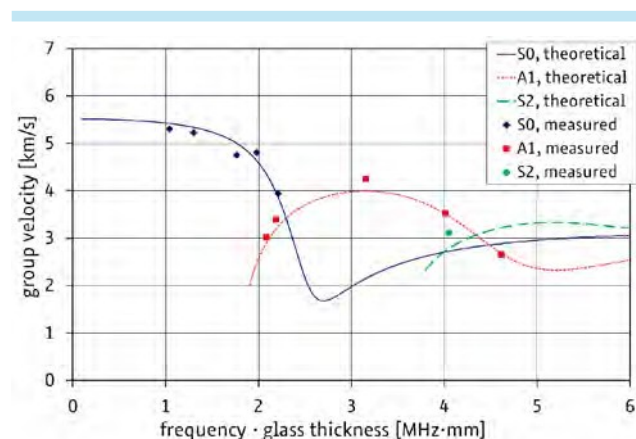
In the experiment, different Lamb wave modes are stimulated in thin glass plates using specific angle beam wedges and their frequency and group velocity are determined. The formation of different oscillation modes of a plate, the influence of plate thickness and the connection of Lamb waves with transverse and shear waves in conjunction with the elastic constants of the material is discussed.

Equipment

Ultrasonic echoscope GS200	10400
2 ultrasonic probes 1 MHz	10151
2 ultrasonic probes 2 MHz	10152
2 ultrasonic probes 4 MHz	10154
Lamb wave set	10300
Ultrasonic gel	70200

Results

S0, A1 and S2 modes were stimulated in the glass plates by combination of different incidence angles and sound frequencies. In the dispersion chart below, the determined group velocities are entered depending on the product of frequency and thickness of the respective glass plate. Furthermore, the chart shows the theoretical curve of dispersion (numerical solution) of the dispersion properties of the stimulated Lamb wave modes.



Related experiments

- PHY02 Sound velocity in solids
- PHY07 Shear waves in solids
- PHY19 Phase and group velocity
- IND02 Detection of cracks with Rayleigh waves
- IND08 Detection of discontinuities