New Method for Enlarging the Measuring Range of the Pulse-Echo Technique for Supercritical States

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Speed of sound data play an important role for the development and parameterization of equations of state for fluids. One method for the measurement of the speed of sound in fluids is the pulse-echo technique, where the propagation time of an acoustic wave burst in a fluid over a known propagation distance is determined [1]. This method is limited by the sampling of received echoes of the acoustic wave bursts, depending on damping due to acoustic impedance and attenuation effects. Improving this sampling by signal enhancement, applying a Fast Fourier Transformation on acoustic wave echoes, increases the signal-to-noise ratio and enhances the time and amplitude resolution. Additional pulse design leads to technical advantages for determining the propagation time also for highly distorted echoes due to the conditioning of the waveform of the echo. It is shown that this newly devised evaluation process significantly enlarges the measuring range of the pulse-echo technique in supercritical states.

References

[1] Frithjof H. Dubberke, David B. Rasche, Elmar Baumhögger, and Jadran Vrabec: *Apparatus for the measurement of the speed of sound of ammonia up to high temperatures and pressures*, Review of Scientific Instruments 85, 084901 (2014); doi: 10.1063/1.4891795