

Original Paper

Development of an Improved Acoustic Dispersion Measurement Technique in Liquids

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Abstract

The present paper is an extension of our earlier series of studies carried out on technique of ultrasonic phase velocity measurement in liquid/mixtures (Joshi et al. MAPAN J Metrol Soc India 29:9–17, 2014) with modified/improved designs related to jigs and fixtures, temperature stability arrangement, improved data acquisition for digitization by using 2.5 GS/s sampling frequency. An improved dispersion measurement technique in liquids is described herein this paper. We have also described a method of estimation of measurement uncertainty in the ultrasonic phase velocity measurements. The parametric uncertainty components are evaluated using Type A and Type B approaches. Several design and developmental aspects are also introduced to enable the technique with improved measurement uncertainty. The technique thus developed has been tested on water sample with repetitive measurements, achieving measurement uncertainty of $\pm 0.5 \text{ ms}^{-1}$ in phase velocity. The repetitive experiments have been performed in water as a function of temperature ranging from 15 to 35 °C and frequency range from 3–7 MHz. The results are discussed in the light of improvements in the technique.

Keywords

Uncertainty – Dispersion – Phase Velocity – Water – Technique