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Development of an acoustics-based instrument for bubble measurement in liquids

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The acoustic bubble spectrometer (ABS) is an acoustics-based device that provides bubble size distribution in a bubbly liquid through measurement at various frequencies of the sound speed and attenuation and solution of an inverse problem. Acoustic bursts of varying frequencies are emitted by one hydrophone and detected by another. A PC and data boards control signal generation, detection, signal processing, inverse problem solution, and results display. Extensive validation experiments were conducted against high speed-video optical measurements. The two methods give very close results for void fractions up to $3e-3$, with the ABS possessing the significant advantage of enabling near real-time measurements. The field of application is being expanded to media other than water, and the technique improved to detect larger void fractions, with the help of numerical simulations of non-linear behavior of bubble clouds in acoustic fields.