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Highly sensitive direct conversion ultrasound interferometer OLEKSIY SVITELSKIY, Gordon College, MA 01982, JOHN GROSSMANN, Colgate University, NY 13346, ALEXEY SUSLOV, National High Magnetic Field Laboratory, FL 32310 — Being invented more than fifty years ago, the ultrasonic pulse-echo technique has proven itself as a valuable and indispensable non-destructive tool to explore elastic properties of materials in engineering and scientific tasks. We propose a new design for the instrument based on mass-produced integral microchips. In our design the radiofrequency echo-pulse signal is processed by AD8302 RF gain and phase detector (www.analog.com).Its phase output is linearly proportional to the phase difference between the exciting and response signals. The gain output is proportional to the log of the ratio of amplitudes of the received to the exciting signals. To exclude the non-linear fragments and to enable exploring large phase changes, we employ parallel connection of two detectors, fed by in-phase and quadrature signals respectively. The instrument allowed us exploring phase transitions with precision of $\Delta V/V \sim 10^{-7}$ (V is the ultrasound speed). The high sensitivity of the logarithmic amplifiers embedded into AD8302 requires good grounding and screening of the receiving circuitry.

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