Abstracts

Acoustic sensing using radio frequency detection and capacitive micromachined ultrasonic transducers

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Broadband acoustic sensing over several decades of frequency has traditionally been difficult to achieve. Conventional condenser and electret microphones depend on membrane and cavity resonances to achieve their maximum sensitivity. However, such resonant phenomena are inherently narrowband and limit the applicable frequency range of the acoustic sensor. New microphones using capacitive micromachined ultrasonic transducer (CMUT) technology and radio frequency (RF) detection achieve a relatively flat acoustic frequency response from frequencies below one hertz to hundreds of kilohertz. In this detection method, a high-frequency carrier signal is launched down a capacitively-loaded transmission line consisting of capacitive micromachined membranes and interconnects. The resulting phase modulation of the carrier due to impinging sound pressure can be measured. Preliminary experiments demonstrate microphone sensitivities of 50 dB/Pa/Hz/spl plusmn/3 dB over a frequency range of 0.1 Hz to 300 kHz. Calculations reveal that sensitivities on the order of 100 dB/Pa/Hz greater than the sensitivity of the human ear, may be possible with a 1 cm/sup 2/ device and a carrier frequency of several gigahertz.

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