Therapeutic Ultrasound Transducer Chip with an Integrated Ultrasound Imager

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Technology description

A therapeutic ultrasound device, with built-in imaging capability for minimally invasive treatment. On the chip, high-power capacitive micromachined ultrasonic transducer (CMUT) and imager CMUT are monolithically integrated on a micromachined silicon substrate for minimally- or non-invasive treatment.

Background

For therapeutic ultrasound, real-time monitoring of a biological object is of critical importance to the patient's safety and the success of the procedure or operation. While magnetic resonance imaging (MRI) and non-invasive ultrasound imaging have been conventionally used for this purpose, they provide a limited viewing angle and/or images with limited spatial resolution. For many high-precision invasive operations, such as, peripheral thrombolysis, in-situ imaging capability is highly desired. Some conventional capacitive micromachined ultrasonic transducers insert a dielectric layer between the electrode on the membrane and its counter electrode to prevent the membrane electrode from contacting the counter electrode in a collapse event such as, during an ultrasound transduction. However, the dielectric layer insert between the membrane and the counter electrode increases the effective gap height of the capacitive micromachined ultrasonic transducer, as well as the voltage required to drive the transducer.

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Publications

A Monolithic Three-Dimensional Ultrasonic Transducer Array for Medical Imaging
A Miniature Capacitive Micromachined Ultrasonic Transducer Array for Minimally Invasive Photoacoustic Imaging
Capacitive micromachined ultrasonic transducer arrays for minimally invasive medical ultrasound
"Fabrication and characterization of surface micromachined CMUT with a bossed membrane",
Ultrasonics Symposium, 2008. IUS 2008. IEEE

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Application area

Delivers a higher average acoustic energy
Dual imaging and stimulation function
Designed to work as a phase array to deliver electronically-focused ultrasound
Allows for real-time acquisition
Affordable equipment cost
Allows for miniaturization in minimally invasive applications

Institution

The University of New Mexico

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