Simulation Study of Different Capacitive Micromachined Ultrasonic Transducer (CMUT) Structures

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ABSTRACT

The Capacitive Micromachined Ultrasonic Transducers (CMUTs) is a Micro-Electro-Mechanical System (MEMS) device. This paper presents the design and simulation of Capacitive Micromachined Ultrasonic Transducers (CMUTs) for medical imaging and therapy applications. The CMUTs are replacement technology of piezoelectric transducers. Because, piezoelectric transducers have some disadvantages like, impedance mismatching with air, high dielectric losses at higher frequencies and more self-heating compare to CMUTs. This disadvantages of piezoelectric transducers, force us, to move from piezoelectric transducers to CMUTs technology. In this paper, we discussed about all CMUTs geometries, like, circular, hexagonal, rectangular and square. All geometries have own frequency at same biasing condition. The simulation process has been done by using MEMCAD tool CoventorWare®. In this simulation process, the various analysis like modal, harmonic analysis, damping analysis and transient analysis have been performed. The CMUTs device has designed for air coupled medium. The glass substrate has been used for cavity formation and SOI wafer for membrane deposition. Ti/Cr and Au have been used for bottom electrode to reduce the parasitic capacitance and Ti/Au have used for top electrode formation. Silicon and silicon dioxide materials are used for membrane formation.

Keyword**:** - MEMS, CMUT, CoventorWare®, Anodic bonding.