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Method and Tool for CMUT Network Simulation

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Abstract

The Capacitive Micromachined Ultrasound Transducers (CMUT) is a promising alternative to piezo-electric ultrasound transducers. They are constituted by a very large number of micro-membranes organized in network and electrostatically actuated. We propose an original method of calculation, allowing to determine the acoustic pressure emitted by the network by taking into account explicitly the dynamics of every micro-membrane. The dynamic displacement of membranes is decomposed on a mechanical modal base and the acoustic radiation pressures are computed via the Rayleigh integral. The originality of the method is that each membrane is explicitly represented in the model. The method was programmed for circular membranes and applied successfully to a network of 300 cells emitting in water. The 1D network with 6 elements of 50 membranes each has been excited by $U_{dc}+U_{ac}$. The U_{ac} has a 36° phase difference between elements. Harmonic displacement of the membrane center are represented for two different frequencies in piston mode on figure 0.1 . Side effects and strong couplings between cells due to network modes, are clearly brought to light.

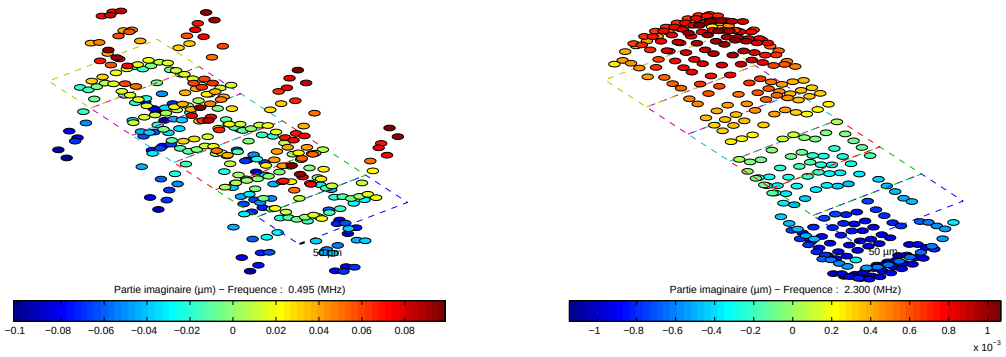

Figure 0.1: Displacement of the membrane center represented in piston mode for two different frequencies