Time-dependent Study of Pressure Waves Generated By Square Array MEMS Ultrasound Transducers

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Abstract

For non-imaging wearable ultrasound applications Novioscan is developing piezoelectric MEMS transducers.
These transducers consist of a large array of micromechanical silicon membranes with piezoelectrically actuated regions to generate an out-of-plane displacement causing a pressure wave in the adjacent medium. For a typical application of echo sounding in a human body such transducers operate in pulsed transmission mode.
We built a simulation model for the time-dependent study of the membrane motion of and the pressure waves generated by such a transducer in the acoustically very similar medium of water. The model deals with the full piezo-acoustics using the Acoustics Module in 3D geometry to find consistent results on acoustic far-field pressure. Furthermore the dependency of this far-field pressure on pulse duration and membrane pitch distance is shown. In conclusion we discuss solution accuracy and the significance of the simulation model for efficient design of these transducers.