Volumetric Synthetic Aperture Imaging with a Piezoelectric 2-D Row-Column Probe.

The synthetic aperture (SA) technique can be used for achieving real-time volumetric ultrasound imaging using 2-D row-column addressed transducers. This paper investigates SA volumetric imaging performance of an in-house prototyped 3 MHz λ/2-pitch 62×62 element piezoelectric 2-D row-column addressed transducer array. Utilizing single element transmit events, a volume rate of 90 Hz down to 14 cm deep is achieved. Data are obtained using the experimental ultrasound scanner SARUS with a 70 MHz sampling frequency and beamformed using a delay-and-sum (DAS) approach. A signal-to-noise ratio of up to 32 dB is measured on the beamformed images of a tissue mimicking phantom with attenuation of 0.5 dB cm\(^{-1}\) MHz\(^{-1}\), from the surface of the probe to the penetration depth of 300λ. Measured lateral resolution as Full-Width-at-Half-Maximum (FWHM) is between 4λ and 10λ for 18 % to 65 % of the penetration depth from the surface of the probe. The averaged contrast is 13 dB for the same range. The imaging performance assessment results may represent a reference guide for possible applications of such an array in different medical fields.

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, Department of Micro- and Nanotechnology, MEMS-AppliedSensors, Center for Fast Ultrasound Imaging, Sound Technology, Inc., BK Medical ApS
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Number of pages: 9
Publication date: 2016