Further development of synthetic aperture real-time 3D scanning with a rotating phased array

In a previous paper, we have presented an approach combining synthetic transmit aperture imaging with a rotating phased array. The method is implemented on a specially made Vermon transducer capable of rotating at 5 Hz. The center frequency of the transducer is 3.2 MHz, and the pitch is 0.22 mm. The array active diameter is 16 mm and the number of elements is 64. The method is capable of scanning 10 volume/sec. The order in which the transmit elements were fired made it possible to achieve lateral resolution of a 0.94 mm at 45 mm depth, which is comparable to a standard B-mode scan. The penetration depth was > 10 cm due to the use of 20 μs long frequency modulated (FM) pulses. The dynamic range was limited to 45 dB because of the nonoptimized FM pulse and grating lobes. This paper presents the work on improving the image quality of the approach: (1) instead of defocusing conventional focusing with an f-number of 1 is used to transmit to create spherical waves, (2) virtual receive elements are synthesized to decrease noise and grating lobes, (3) the compression filter for the FM pulses was modified to suppress the range lobes (4) additional hardware for synchronization is built.

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