A phantom study on temporal and subband Minimum Variance adaptive beamforming

This paper compares experimentally temporal and subband implementations of the Minimum Variance (MV) adaptive beamformer for medical ultrasound imaging. The performance of the two approaches is tested by comparing wire phantom measurements, obtained by the research ultrasound scanner SARUS. A 7 MHz BK8804 linear transducer was used to scan a wire phantom in which wires are separated by 10 mm. Performance is then evaluated by the lateral Full-Width-Half-Maximum (FWHM), the Peak Sidelobe Level (PSL), and the computational load. Beamformed single emission responses are also compared with those from conventional Delay-and-Sum (DAS) beamformer. FWHM measured at the depth of 46.6 mm, is 0.02 mm (0.09λ) for both adaptive methods while the corresponding values for Hanning and Boxcar weights are 0.64 and 0.44 mm respectively. Between the MV beamformers a -2 dB difference in PSL is noticed in favor of the subband approach (-31 and -33 dB), whereas values from conventional are not lower than -29 dB. This slight improvement in the case of the subband implementation comes at the expense of increased computational cost; 3.7 TFLOPs per image are required in contrast to 130 GFLOPs of the temporal one, when only 0.5 GFLOPs are needed in DAS beamforming.

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