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(Research Article)
Adaptive beamforming in row-column addressed arrays for 3D ultrasound imaging

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Abstract

In recent years, to reduce the complexity of implementation, the use of 2D arrays with restricted row-column addressing has been considered for 3D ultrasound imaging. In this paper, two methods of adaptive beamforming based on the minimum variance method are represented in such a way that the computational load is much less than using the full adaptive beamforming method. In both proposed methods, to reconstruct each point of the image, only two covariance matrices and two weight vectors are determined. These methods perform significant improvement both in lateral resolution and contrast compared with delay and sum method. To evaluate the proposed methods, the data obtained from a 32+32 element array has been analyzed using the FIELD-II ultrasound simulator. By using a point phantom, it has been shown that the value of the full width at half maximum of the point spread function is reduced by 95% in the first method compared to the delay and sum method. Also, by using the cyst phantom, it can be seen that the contrast ratio and the contrast to noise ratio can be improved by almost 100% and 50%, respectively in comparison to the delay and sum method.

Keywords: 3-D ultrasound imaging, 2-D array transducer, Row-column addressing, Beamforming, Minimum variance.

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