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Title:Towards three-dimensional millimeter-wave radar with the bistatic fast-factorized back-projection algorithm-potential and limitations

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Abstract:In this paper, we report on a time-domain approach for 3-D synthetic image reconstruction at stand-off distances called the bistatic fast-factorized back-projection (BiFFBP) algorithm. Although the algorithm is suited for multiple purposes, it is applied in this paper to a millimeter-wave radar system that operates in a frequency-modulated continuous-wave mode between 234 and 306 GHz. After initially mapping the bistatic to a quasi-monostatic configuration, the algorithm recursively factorizes both, the aperture positions and the target area. Three-dimensional reconstructions are shown for a simulated point-target in order to evaluate the point-spread-function of the system. In addition, 2-D-imaging is performed on real objects at stand-off distances using a scanner system that consists of 8 transmitters and 16 receivers. Reconstructions with the BiFFBP-algorithm are compared with the global back-projection (GBP) algorithm that serves as a benchmark. The results show that the BiFFBP-approach yields similar results to the GBP with respect to dynamic range in the image and the overall image quality. It is also shown that a resolution of 2 cm can be achieved with relatively few elements, no scanning, and over a large field-of-view. © 2012 IEEE.

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