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Robust beamforming and beamspace DOA estimation using measured array manifold of arbitrary geometry acoustic array

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The acoustic diffraction of array supporting structure will result in the large difference of the amplitude and phase response of each hydrophone, which leads to the distortion of beampattern. A method for obtaining the array manifold of arbitrary geometry acoustic array is proposed in this paper. We measured the array response vector in many directions with a fixed angular step in anechoic water tank. The array response vectors were smoothed to eliminate the measurement system error. Using these smoothed array response vectors, the robust beampattern of arbitrary geometry array is obtained via beam synthesis method. A 16 element volumetric acoustic array was constructed and tested in an anechoic water tank. Robust low sidelobe beampatterns based on the measured manifold were formed, and then the beamouputs were used to apply to beamspace high resolution DOA estimation methods. The experimental results show that our method can suppress noise and interferences outside the beam coverage regions, and get high resolution DOA estimation results. When the array geometry has some distortion, the weighting vectors of beamforming can still work well to form good beampatterns, and then get accurate DOA estimation results. This verifies the effectiveness of our proposed method.