

# DOA Estimation by Using Randomly Distributed Radar Array with Signal Processing Technique

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Direction-Of-Arrival (DOA) estimation by using the Uniform Circular Array (UCA) or the Uniform Linear Array (ULA) is very popular in communication and radar fields, and many high angular resolution algorithms, e.g., MUSIC, APES, and etc., have been developed for different applications. However, the DOA estimation by using the UCA or the ULA has some limitations, i.e., strict geometry model requirement, amplitude and phase calibration for the sensors, and unreliability when some sensors are not available. In this paper, we investigate a framework based on the randomly distributed radar array for DOA estimation, and also present a hybrid approach which combines the correlation method and the basis matrix method with Singular Value Decomposition (SVD) for achieving much higher angular resolution. The hybrid method involves generating a data matrix from different incident angles by recording the observation for each sensor of the array either by simulation or real measurement. Following this, we correlate the measurement with generated data matrix, to make an initial estimate of the angular regions of possible DOAs. We then apply the basis matrix method based on the SVD of the data matrix to estimate the angles of incidence accurately. Numerical results show that the proposed hybrid approach can achieve a high resolution even when the sensors are randomly distributed. Furthermore, the proposed framework does not require a strict geometry model and works very well even if some sensors are malfunctioned or missing. Our future works will focus on how to set the phase reference point for the randomly distributed radar array practically, as well as how to make the echoes from each sensor coherent.

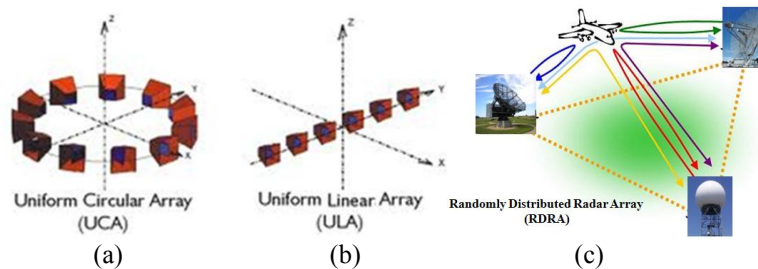


Fig. 1 (a) Uniform circular array; (b) uniform linear array; and (c) randomly distributed radar array.

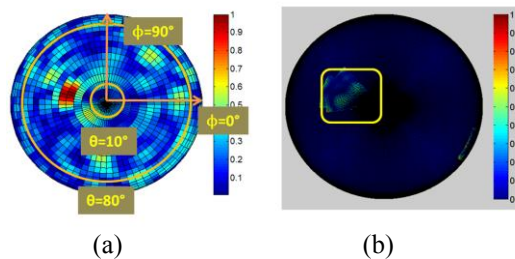


Fig. 2 Recovered DOAs by using (a) correlation method and (b) basis matrix method.