

Design of Polarization Reconfigurable Antenna Array with the Method of Maximum Power Transmission Efficiency

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The design of polarization reconfigurable antenna arrays typically relies on introducing phase differences among elements or rotating elements according to empirical rules, which is focused on configuring the antenna array itself. This presentation shows an alternative approach that shifts the focus to a two-port test receiving antenna in the far-field region, through which the polarization performance of the array under design can be easily controlled by maximizing the power transmission efficiency between the array and the two-port test receiving antenna while the latter is constrained by the power ratio and phase difference between the two ports. As a result, the design of a polarization reconfigurable antenna array becomes a constrained optimization problem. By altering the types of constraints introduced in the two-port test receiving antenna, the performances of the array can meet various application requirements on polarization, gain and radiation pattern. Specifically, by varying the amplitude and phase of the incident waves at the two orthogonal ports of the test receiving antenna, the polarization of the array antenna under design can be precisely determined. Furthermore, by adjusting the spatial locations and the number of the test receiving antennas, the beam scanning, multi-beam and beam shaping capabilities can be achieved. The design procedure is illustrated in Figure 1. Compared with existing optimization methods based on the array factor and various algorithms, the proposed method fully accounts for the mutual couplings among elements, and requires no iterative time apart from a one-time full-wave simulation by using electromagnetic simulation software. Accordingly, the array designs based on the proposed method are free from the limitations upon the use of different element types, the array configurations and inter-element spacing, thereby offering significant advantages in practical applications.

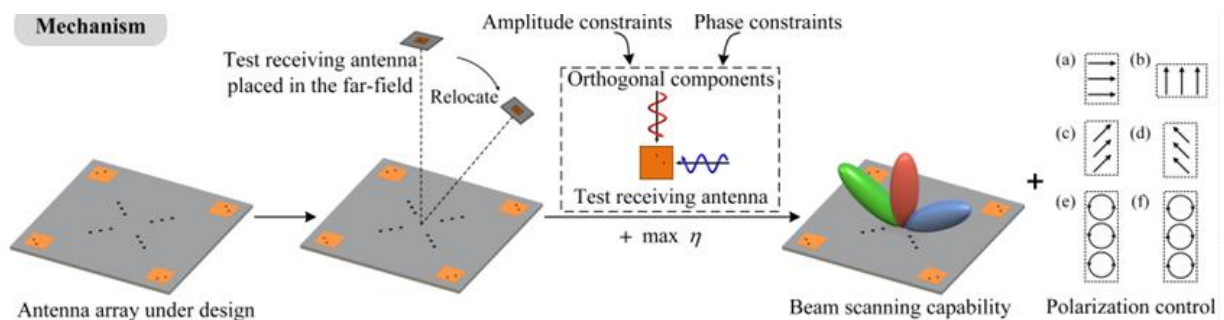


Figure 1. Design of antenna array.