Synthesis Techniques for Antenna Arrays - Fundamentals and Introductory Methods (Part 2)

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Abstract

Antenna arrays represent a fundamental technology in several Electromagnetics applicative scenarios, including satellite and ground wireless communications, MIMO systems, remote sensing, biomedical imaging, radar, and radio-astronomy. For instance, phased array systems comprising several hundreds or thousands radiating elements are nowadays commonly used in high-end radars for aerial and maritime platforms.

Because of their wide range of application, the large number of degrees of freedom in the synthesis (comprising the type, position, and excitation of each radiating element in the layout), the available architectures (fully populated, thinned, clustered, etc.), and the possible objectives (maximum directivity, minimum sidelobes, maximum beam efficiency, etc.), the synthesis of arrays turns out a complex task which cannot be tackled by a single methodology. Accordingly, several techniques have been developed in the last sixty years to address such design problems. Despite such heterogeneity, most of the techniques share a common theoretical framework which is of paramount importance for all engineers and students interested in such a topic.

The objective of the short-course is therefore to provide the attendees the fundamentals of Antenna Array synthesis, starting from intuitive explanations to rigorous mathematical and methodological insights about their behavior and design.

More in detail, the following topics will be covered during the lessons

- Array Analysis – Resume on Uniform linear array (ULA). Non uniform linear arrays (USLA).
- Array Synthesis – Schelkunoff synthesis method (zero tuning); Fourier synthesis method; Woodward-Lawson technique; Dolph-Chebyshev method (equiripple); Least Square method; Taylor synthesis; Bayliss method; Iterative Projection method.

Some recent Antenna Array synthesis will be finally reviewed with particular emphasis on innovative architectures for large arrays.

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