Preface

Orthogonal methods for array synthesis are designed to meet the needs of antenna engineers and graduate students of Electrical and Computer Engineering and Physics Departments. The objective of the present book is to describe a relatively simple approach to the design of antenna arrays.

Essentially, the book represents the theory and applications of the Orthogonal Methods (OM), including the corresponding details of over two-decades of comprehensive research activity at the Radiocommunications Laboratory at the University of Thessaloniki, Greece. The use of plural in the term ‘Orthogonal Methods’, instead of ‘Method’, was considered to be preferable. That was justified by the fact that the orthogonalization of the vector space in array synthesis contains different procedures for different purposes. A considerable attempt to make the book as complete and self-contained as possible has been made.

The five chapters of the book address the following topics:

Chapter 1 is an introductory chapter that contains the basics and theory of antennas and antenna arrays. Chapter 2 gives an overview of the most common antenna arrays. Linear arrays with uniform excitations as well as Chebyshev and other non-uniform excitations are presented. Furthermore, planar, rectangular and circular as well as 3-D and conformal arrays are also outlined. Chapter 3 contains most of the well-known array design techniques. The pattern synthesis of several uniform and non-uniform arrays is explained. Array design procedures by sampling or by root matching of Taylor and Bayliss line sources are analyzed. Moreover, matrix methods, simplex and gradient methods, simulated annealing and genetic algorithms are discussed for the design of antenna array systems. Antenna arrays combined with signal processing, known as ‘smart antennas’, are also given. Chapter 4 describes the Orthogonal Methods. After an introduction to the essential works of Unz and Uzko, the classical orthogonal method with and without constraints for linear, planar and 3-D arrays is presented. Moreover, the orthogonal method with the method of moments and the orthogonal compensation method are given. The conformal orthogonal method is also presented. Finally, the orthogonal perturbation method for the geometry synthesis is described. The chapter details extensively the applications of the OM to the design of antenna arrays with a wide list of array patterns.

In the last chapter, the ORAMA computer tool, with the instructions on how to use the material in the accompanying CD, is explained. ORAMA, in the given version, contains the programs of the classical Orthogonal Method for synthesis of linear arrays. The design cases cover a sufficient number of needs of antenna engineers and graduate students.
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