
PREFACE

This book is the result of close cooperation between industry and academia, notably Ericsson and two universities in Sweden: Chalmers University of Technology (CTH) in Göteborg and The Royal Institute of Technology (KTH) in Stockholm. In 1987, a student at CTH presented her PhD thesis on the topic of conformal antennas. It was then considered an interesting but difficult technology with no immediate application. About 10 years later, many conformal array applications were seriously considered or in development. At that time, we became involved in several conformal R&D programs that also included experimental hardware for model verification. Our intention was to compile results from these efforts into one, thick internal report. However, with the support and encouragement from many colleagues, we set out on the much more demanding route to write a book on the subject.

Many standard textbooks on antennas include short sections on conformal array antennas, but usually only simple reference cases are treated. The mutual coupling (which is an important parameter) is often just briefly mentioned. Examples of array characteristics with the mutual coupling included are rare. Thus, we believe this book fills a gap in the existing literature.

Our purpose is to present the fundamental principles behind conformal antennas, as well as hands-on information necessary for the analysis and design of conformal antenna arrays. Graphical illustrations are used extensively, both for calculated and measured results, including results not published before. We describe theoretical methods for analysis and design, and include explicit formulas where applicable. From a practical point of view, mechanical aspects, beam-forming techniques, and packaging of conformal array antennas are included. Furthermore, scattering properties are discussed, which are of interest in stealth applications, for example. Lists of references are provided at the end of each chapter for further studies. Thus, we hope that the book will become a useful tool for the practicing antenna and systems engineer in understanding and working with these interesting antennas.

Each chapter starts with some introductory material, that is, the basic concepts that are essential to get an understanding of the more advanced aspects. The first three chapters present an overview of conformal array principles and applications, including the theory for circular arrays and phase mode concepts, and discussions of various shapes of conformal arrays.

In Chapters 4 and 5, theoretical methods for analysis and design are described, including explicit formulas; for example, for geodesics on more general surfaces than the canonical circular cylinder and sphere. Doubly curved surfaces and dielectric covered surfaces using high-frequency methods are also included. Two canonical examples are also discussed in detail, thus assisting the reader in his/her own conformal antenna analysis.

Chapters 6 and 7 deal with radiating elements on singly curved and doubly curved surfaces. The focus is on mutual coupling characteristics and element radiation properties. Element types include waveguide-fed apertures and microstrip patches. For both types, measured data supports the calculated results.

Chapters 8 and 9 treat conformal array antenna characteristics—radiation, impedance and polarization—as well as mechanical and packaging aspects. Feeding systems and beam-scanning principles are also included.

Chapter 10 discusses various synthesis methods, with some examples. Also, aspects such as optimizing the shape, distribution of elements, polarization, and bandwidth are included.

The final chapter deals with methods for the analysis of scattering (radar cross section) from conformal array antennas; in particular, waveguide-fed aperture elements with and without a dielectric coating. We include also a discussion on the problem of reducing the radar cross section without decreasing the antenna performance.

While written with engineering applications in mind, this book can also serve as a text for graduate courses in advanced antennas and antenna systems.

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