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Modern Lens Antennas for Communications Engineering

John Thornton • Kao-Cheng Huang

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MODERN LENS
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CONTENTS

Preface	ix
Acknowledgments	xi
1 INTRODUCTION	1
<i>John Thornton and Kao-Cheng Huang</i>	
1.1 Lens Antennas: An Overview	2
1.1.1 The Microwave Lens	2
1.1.2 Advantages of Lens Antennas	4
1.1.3 Materials for Lenses	5
1.1.4 Synthesis	6
1.2 Feeds for Lens Antennas	8
1.2.1 Microstrip Feeds	8
1.2.2 Horn Feeds	9
1.3 Luneburg and Spherical Lenses	10
1.4 Quasi Optics and Lens Antennas	14
1.5 Lens Antenna Design	18
1.6 Metamaterial Lens	26
1.7 Planar Lens or Phase-Shifting Surface	30
1.7.1 Reflect Array	31
1.7.2 Planar Lens or Lens Array	33
1.8 Applications	36
1.9 Antenna Measurements	37
1.9.1 Radiation Pattern Measurement	37
1.9.2 Gain Measurement	38
1.9.3 Polarization Measurement	38
1.9.4 Anechoic Chambers and Ranges	38

2	REVIEW OF ELECTROMAGNETIC WAVES	49
	<i>Kao-Cheng Huang</i>	
2.1	Maxwell's Equations	49
2.1.1	Boundary Conditions	53
2.1.2	Equivalence Theorem	55
2.2	Antenna Parameters	56
2.2.1	Beam Solid Angle and Antenna Temperature	56
2.2.2	Directivity and Gain	58
2.2.3	Antenna Beamwidth	60
2.2.4	Aperture of a Lens	62
2.2.5	Phase Center	63
2.3	Polarization	64
2.4	Wave Propagation in Metamaterials	71
3	POLYROD ANTENNAS	77
	<i>Kao-Cheng Huang</i>	
3.1	Polyrods as Resonators	78
3.2	The Polyrod as a Radiator	83
3.2.1	Tapered Polyrod Antenna	85
3.3	Patch-Fed Circular Polyrod	90
3.4	Array of Polyrods	97
3.5	Multibeam Polyrod Array	105
4	MILLIMETER WAVE LENS ANTENNAS	113
	<i>Kao-Cheng Huang</i>	
4.1	Millimeter Wave Characteristics	114
4.1.1	Millimeter Wave Loss Factors	114
4.1.2	Ray-Tracing Propagation	117
4.2	Millimeter Wave Substrate Lens for Imaging	121
4.3	Millimeter Wave and Submillimeter Wave Lens	126
4.3.1	Extended Hemispherical Lens	128
4.3.2	Off-Axis Extended Hemispherical Lens	133
4.3.3	Submillimeter Wave Lens Antennas for Communications	136
4.4	Analysis of Millimeter Wave Spherical Lens	139
4.5	Waveguide-Fed Millimeter Wave Integrated Lens	141

5	LENS ANTENNAS FOR COMMUNICATIONS FROM HIGH-ALTITUDE PLATFORMS	147
	<i>John Thornton</i>	
5.1	Introduction	147
5.2	The High-Altitude Platform Concept	148
5.2.1	Spectrum Reuse Using HAPs	150
5.2.2	Example Results: Cell Power and Interference	155
5.3	Advantages of Lenses over Reflector Antennas	159
5.3.1	Reflectors	160
5.3.2	Lenses	161
5.3.3	Commercial Lens Antennas	162
5.4	Development of a Shaped Beam Low-Sidelobe Lens Antenna with Asymmetric Pattern	164
5.4.1	Primary Feed	165
5.4.2	Symmetric 5° Beamwidth Antenna	166
5.4.3	Asymmetric Beam	166
5.4.4	Measurements	174
5.5	Lens Antenna Payload Model	177
5.6	Multifeed Lens	178
5.7	Multiple Beam Spherical Lens Antennas for HAP Payload	181
6	SPHERICAL LENS ANTENNAS	187
	<i>John Thornton</i>	
6.1	Introduction	187
6.2	Spherical Lens Overview	192
6.3	Analytical Methods	195
6.3.1	Ray Tracing	195
6.3.2	SWE	197
6.3.3	Computational Method and Results	202
6.3.4	Generic Feed Pattern	206
6.3.5	Commercial Solvers	208
6.4	Spherical Lens Materials and Fabrication Methods	210
6.4.1	Machined Polymers	210
6.4.2	Molding	212
6.4.3	Polymer Foams	212
6.4.4	PU Dielectric Loss	214
6.4.5	Artificial Dielectrics	215

6.5	Revisiting the Constant-Index Lens	215
6.5.1	A Practical, Patch-Fed Hemispherical Constant-Index Lens	219
6.5.2	Off-Axis Array-Fed Spherical Lens	219
6.6	Cross-Polarization Properties of Spherical Lenses	221
7	HEMISPHERICAL LENS-REFLECTOR SCANNING ANTENNAS	225
	<i>John Thornton</i>	
7.1	Introduction	225
7.2	Candidate Scanning Antenna Technologies	226
7.3	Spherical and Hemispherical Lens Antenna	228
7.4	Hemispherical Lens Prototype	229
7.5	Evolution of a Two-Layer Stepped-Index Polymer Lens	232
7.6	A Hemispherical Lens-Reflector Antenna for Satellite Communications	238
7.6.1	Requirements	239
7.6.2	Lens Analysis	240
7.6.3	Three-Layer Lens Geometry	240
7.6.4	Lens Fabrication and Performance	243
7.6.5	Mechanical Tracking System	245
7.6.6	Ground Plane Effects	249
7.6.7	Aperture Blockage in Scanning Lens Reflector	251
7.7	A Low-Index Lens Reflector for Aircraft Communications (Contribution by D. Gray)	252
	About the Authors	267
	Index	268

PREFACE

The aim of this book is to present the modern design principles and analyses of lens antennas. It gives graduates and RF/microwave professionals the design insights in order to make full use of lens antennas. The reader might ask: Why is such a book considered necessary and timely? The reply we would bring to such an inquiry is that the topic has not been thoroughly publicized recently and so its importance has become somewhat underestimated. Furthermore, the work has brought about an opportunity to gather together the authors' contributions to several areas of research where lens antennas have been promoted. Foremost among these are communications applications, where of course antennas play a key role and where we will show why certain advantages accrue from the particular characteristics of lens antennas.

The major advantages of lens antennas are narrow beamwidth, high gain, low sidelobes and low noise temperature. Their structures can be more compact and weigh less than horn antennas and parabolic reflector antennas. Lens antennas, with their quasi-optical characteristics, also have low loss, particularly at near millimeter and submillimeter wavelengths where they have particular advantages. Beam shaping can be achieved by controlling the phase distribution across the lens aperture in a manner that can be more accurate and less costly than would be the case for a reflector. Such a shaped dielectric lens can be more economical to produce in small- to medium-scale production runs than other antenna types where certain niche applications are considered. In addition, spherical lens antennas have the benefit of no scan loss and wide bandwidth, with the option for multiple beams from a common aperture.

Modern Lens Antennas for Communications Engineering serves as an excellent tool for RF/microwave professionals (engineers, designers, and developers) and industries with microwave and millimeter wave research projects. For university students, this book requires a prerequisite course on antennas and electromagnetic waves, which covers propagation, reflection, and transmission of waves, waveguides, transmission lines, and some other antenna fundamental concepts. Such a course is usually followed by design projects. This book can be used as further study material in such design projects. Advanced students and researchers working in the field of modern communications will also find this book of interest. Included is a bibliography of current research literature and patents in this area.

Based on these credentials, this book systematically conducts advanced and up-to-date treatment of lens antennas. It does not purport to present a far-reaching treatise on every aspect of lens antennas, but rather, following the introductory chapters, the