

Contents

1. Introduction. By R. MITTRA	1
2. Applications of the Method of Moments to Thin-Wire Elements and Arrays. By W. A. IMBRIALE (With 32 Figures)	
2.1. Method of Moments Applied to Wire Antennas	6
2.1.1. Basic Theory	7
2.1.2. Self-Impedance Evaluation	11
2.1.3. Convergence of Moments Solutions	13
2.1.4. Far-Field Evaluation	15
2.1.5. Arbitrarily Shaped Wires and Wire Junctions	15
2.2. Method of Moments Applied to Log-Periodic Dipole Antennas	17
2.2.1. Formulation of the Problem	19
The Transmission Line Admittance Matrix	21
The Dipole Elements Admittance Matrix	22
Far-Field Radiation Patterns	23
2.2.2. Single Log-Periodic Dipole Antenna	25
2.2.3. Coupled LPD Antennas	29
2.2.4. Effects of Feeder Boom	31
2.2.5. The Log-Periodic Fed Yagi	33
2.3. Wire Antennas as Feeds for Parabolic Reflectors	34
2.3.1. Scattering from Parabolic Reflectors	35
2.3.2. Optimum Design of LPD Feeds	37
Design Considerations	38
Optimum Design	42
Example Case	44
Experimental Correlation with Theory	45
2.3.3. Multiple LPD Feeds	47
References	49
3. Characteristic Modes for Antennas and Scatterers. By R. F. HARRINGTON (With 10 Figures)	
3.1. Characteristic Modes for Conducting Bodies	52
3.1.1. Characteristic Currents	53
3.1.2. Characteristic Fields	54

3.2. Modal Solutions	55
3.2.1. Linear Measurements	56
3.2.2. Application to Radiation Problems	57
3.2.3. Application to Scattering Problems	58
3.3. Scattering Matrices	59
3.4. Computation of Characteristic Modes	61
3.4.1. Computations for Bodies of Revolution	63
3.4.2. Convergence of Radiation Patterns	66
3.4.3. Computations for Wire Objects	68
3.5. Control of Modes by Reactive Loading	70
3.5.1. Modes of a Loaded Body	71
3.5.2. Resonating a Desired Real Current	72
3.5.3. A Scattering Example	74
3.5.4. Synthesis of Loaded Scatterers	75
3.6. Characteristic Modes for Dielectric Bodies	77
3.7. Characteristic Modes for N -Port Loaded Bodies	80
3.7.1. Formulation of the Problem	80
3.7.2. N -Port Characteristic Modes	82
3.7.3. Modal Solutions	83
3.7.4. Modal Resonance	84
3.7.5. Synthesis of Loaded N -Port Scatterers	85
3.8. Discussion	85
References	86

4. Some Computational Aspects of Thin-Wire Modeling.

By E. K. MILLER and F. J. DEADRICK (With 8 Figures)

4.1. Introduction	89
4.2. Current Expansions	91
4.2.1. Complete Domain Expansions	92
4.2.2. Sub-Domain Expansions	93
4.3. Structural Segmentation and Boundary Condition Matching	97
4.3.1. Structural Segmentation	98
4.3.2. Boundary Condition Matching	99
4.3.3. Impedance Loading	107
4.4. Multiple Junction Treatment	109
4.5. The Thin-Wire Approximation	112
4.6. Matrix Factorization Roundoff Error	114
4.7. Near-Field Behavior	115
4.8. Wire-Grid Modeling	118
4.9. Computer Time	122
4.10. Observations and Conclusion	123
References	126

5. Stability and Convergence of Moment Method Solutions.

By R. MITTRA and C. A. KLEIN (With 23 Figures)

5.1. Stability	129
5.1.1. Use of Condition Numbers	129
5.1.2. Scattering by Rectangular Conducting Cylinders .	134
5.1.3. Waveguide Discontinuities	143
5.1.4. Wavefront Reconstruction	144
5.1.5. Thin-Wire Antennas	146
5.1.6. Remote Sensing	147
5.2. Convergence	149
5.2.1. Introduction	149
5.2.2. Testing Functions	151
5.2.3. Convergence of Impedance and Admittance . . .	155
5.2.4. Convergence of Non-Local Parameters	160
5.3. Conclusions	162
References	163

6. The Geometrical Theory of Diffraction and Its Application.

By R. G. KOUYOUMJIAN (With 15 Figures)

6.1. Asymptotic Solution of Maxwell's Equations	166
6.1.1. Geometrical Optics	166
6.1.2. Reflection	168
6.1.3. Diffraction	170
6.2. Edge Diffraction	174
6.2.1. The Wedge	174
6.2.2. The General Edge Configuration	180
6.2.3. Higher-Order Edges	183
6.3. Diffraction by a Vertex	183
6.4. Surface Diffraction	184
6.4.1. The Shadow Region	185
6.4.2. The Parameters	190
6.4.3. Transition Regions	195
6.4.4. Two-Dimensional Problems	200
6.5. Applications	200
6.5.1. Reflector Antenna	201
6.5.2. Slot in an Elliptic Cylinder	205
6.5.3. Monopole Antenna Near an Edge	207
6.5.4. Discussion	210
6.6. Conclusions	212
References	213

7. Reflector Antennas. By W. V. T. RUSCH (With 24 Figures)

7.1. Formulation of the Field Equations	218
7.1.1. Free-Space Dyadic Green's Function	218
7.1.2. Physical Optics	219
7.1.3. Aperture Formulation	220
7.2. Numerical Integration Procedures	221
7.2.1. Physical-Optics Analysis of Radiation from a General Surface of Revolution	222
Convergence — An Example Using Dipole Illumination	227
Interval-Halving with Automatic Testing	228
7.2.2. Ludwig Algorithm	229
7.3. High-Frequency Reflectors with Stationary Points	229
7.3.1. Shadow-Region Cancellation	230
7.3.2. Geometrical Optics	231
7.3.3. Stationary Points of the Second Kind (Edge Rays)	235
7.3.4. Geometrical Theory of Diffraction for Reflectors in Free Space	235
Axially Symmetric Reflector for a Vector Spherical- Wave Point Source on Axis	235
Axially Symmetric Reflector for a Vector Spherical- Wave Point Source off Axis	240
Surface-Diffracted Rays	241
Applications	242
7.4. Application of Spherical-Wave Theory to Reflector Feed- System Design	245
7.4.1. NASA/JPL 64-m Antenna Dichroic Feed System	246
7.4.2. Shaped-Beam Pattern Synthesis Using Spherical- Wave Theory	250
7.5. Integral-Equation Analysis of Large Reflectors	250
References	255

Subject Index	257
----------------------	------------

