CONTENTS

PART I. THEORY

I. PRELIMINARIES	3
1.1. Objective	3
1.2. Maxwell's Equations	4
1.3. Fourier Integral Analysis	8
II. PLANE WAVE REPRESENTATION	11
2.1. Plane Waves	11
 2.1.1. Homogeneous Plane Waves in Vacuum 2.1.2. Inhomogeneous Plane Waves in Vacuum 2.1.3. Plane Waves in an Isotropic Medium 2.1.4. Plane Waves in an Anisotropic Medium 2.1.5. An Example 	11 12 15 16 20
2.2. Angular Spectrum of Plane Waves	22
 2.2.1. Plane Surface Currents 2.2.2. Angular Spectrum in Vacuum: Two-dimensional Case 2.2.3. Simple Examples: Line-sources 2.2.4. Angular Spectrum in Vacuum: Three-dimensional Case 2.2.5. Simple Example: Dipole Source 2.2.6. Angular Spectrum in an Anisotropic Medium 	22 23 30 33 35 37
III. SUPPLEMENTARY THEORY	39
3.1. Radiated Power	39
3.1.1. The Two-dimensional Case 3.1.2. The Three-dimensional Case	39 41
3.2. The Radiation Field	43
3.2.1. Heuristic Approach: Stationary Phase 3.2.2. Rigorous Approach: Steepest Descents	43 46
3.3. Angular Spectrum with Simple Pole	51
3.3.1. The Complex Fresnel Integral3.3.2. Reduction to Fresnel Integral3.3.3. Steepest Descents with Saddle-point Near a Pole	51 53 50
3.4. Relation to other Representations	5
3.5. Gain and Supergain	60

viii CONTENTS

PART II. APPLICATION

IV. DIFFRACTION BY A PLANE SCREEN	69
4.1. Black Screen	69
4.1.1. Formulation of the Problem	69
4.1.2. The Half-plane	72
4.1.3. The Slit	76
4.2. Perfectly Conducting Screen	77
4.2.1. Babinet's Principle and the Cross-section Theorem	77
4.2.2. The Half-plane	82
4.2.3. The Wide Slit	84
4.2.4. The Narrow Slit	91 92
4.2.5. Line-source	92
V. PROPAGATION OVER A UNIFORM PLANE SURFACE	98
5.1. Radio Propagation over a Homogeneous Earth	98
5.1.1. Reflection Coefficients for Plane Wave Incidence	98
5.1.2. Solution for a Localized Source: E-polarization	102
5.1.3. Solution for a Localized Source: H-polarization	107
5.1.4. Special Cases	109
5.2. Surface Waves	114
5.2.1. Reactive Surfaces	114
5.2.2. Generation of a Surface Wave	116
5.2.3. Launching Efficiency	118
VI. PROPAGATION OVER A TWO-PART PLANE SURFACE	122
6.1. Perfectly Conducting Half-plane on Surface of Semi-infinite	
Homogeneous Medium	122
6.1.1. Genesis and Nature of the Problem	122
6.1.2. Solution for Incident Plane Wave: H-polarization	125 129
6.1.3. Solution for Line-source: H-polarization 6.1.4. Reduction of the Solution	131
6.1.5. Special Cases	134
6.2. Two-part Impedance Surface	137
6.2.1. Solution for Incident Plane Wave: H-polarization	137
6.2.2. The Split of $\sin \beta + i \sinh \gamma$	140
6.2.3. Surface Wave Reflection and Transmission	143
VII. THE FIELD OF A MOVING POINT CHARGE	145
7.1. Motion in a Plane	145
7.1.1. General Formulation	145
7.1.2. Periodic Motion: Uniform Circular Motion	149
7.2. Uniform Rectilinear Motion	151
7.2.1. Motion in a Vacuum	151
7.2.2. Motion in a Dielectric: Cerenkov Radiation	155

CONTENTS	ix
VIII. SOURCES IN ANISOTROPIC MEDIA	159
8.1. Uniaxial Medium	159
8.1.1. The Dielectric Tensor	159
8.1.2. Surface Currents in Plane Normal to Axis	160
8.1.3. Dipole Normal to Axis	162
8.1.4. Surface Currents in Plane Parallel to Axis	166
8.1.5. Dipole Parallel to Axis	167
8.1.6. Point Charge in Uniform Motion Parallel to Axis	168
8.1.7. TE and TM Resolution	170
8.2. Magneto-ionic Medium	172
8.2.1. Surface Currents in Plane Normal to Magnetostatic Field	172
8.2.2. Surface Currents in Plane Parallel to Magnetostatic Field	174
8.2.3. Point Charge in Uniform Motion Parallel to Magneto- static Field	176
ANNOTATED BIBLIOGRAPHY	181
INDEX	185