

CONTENTS

	PAGE
LIST OF TABLES	ix
ACKNOWLEDGMENTS	xi
LIST OF PRINCIPAL SYMBOLS	xiii
CHAPTER	
1. INTRODUCTION	1
1.1 Scope and Limitations of the Treatment	1
1.2 Field Equations	4
1.3 Hertz Potential	5
1.4 TE and TM Modes	6
1.5 Definitions of Antenna Impedance or Admittance	7
1.6 References	12
2. THIN WIRE ANTENNAS IN FREE SPACE	13
2.1 EMF Method	13
2.2 Hallen's Method	14
2.3 Storer's Variational Solution	17
2.4 Thin Wire Loop Antenna	24
2.5 Appendix: Hertz Vector of a Cylindrical Wire	30
2.6 Exercises	31
2.7 References	32
3. SLOT ANTENNAS IN FREE SPACE	33
3.1 Concept of Complementary Antennas	33
3.2 Rectangular Waveguide with an Infinite Flange	35
3.3 Coaxial Line with an Infinite Flange	39
3.4 Exercises	44
3.5 References	44
4. DIELECTRIC LOADING OF SMALL ANTENNAS	45
4.1 Dielectric Loading of Electric Dipole Antennas	45
4.2 Lossy Cores for Loops and Capacitor Type Antennas	49
4.2.1 Loop Antenna	49
4.2.2 Dipole Antenna	53
4.2.3 Comparison of the Two Antenna Types	54
4.3 Lossy Shells Surrounding Loops and Dipoles	55
4.4 Exercises	58
4.5 References	58
5. TRANSMISSION LINE THEORY OF BURIED INSULATED ANTENNAS	60
5.1 Impedance of the Buried Insulated Wire	60
5.2 Mutual Impedance of Two Buried Antennas	64
5.3 Surface Excitation by a Buried Vertical Line	66
5.4 References	70

CHAPTER	PAGE
6. ANTENNAS IN THE INTERFACE BETWEEN TWO MEDIA	71
6.1 Thin Insulated Wires	71
6.2 Long Slots	72
6.2.1 The Narrow Slot	73
6.2.2 The Wide Slot	78
6.2.3 The Radiation Efficiency of the Slot	80
6.3 Exercises	82
6.4 References	83
7. CAVITY-BACKED SLOT ANTENNAS	84
7.1 Rectangular Slots	84
7.1.1 Integral Equation for the Field Variation in the Slot	84
7.1.2 Variational Solution	86
7.1.3 Hallen's Method	91
7.2 Annular Slot	95
7.2.1 Slot Admittance	95
7.2.2 Cylindrical Cavity	97
7.2.3 Coaxial Cavity	100
7.3 Exercises	102
7.4 References	103
8. SLOT ANTENNAS WITH A STRATIFIED DIELECTRIC OR ISOTROPIC PLASMA LAYERS	104
8.1 Admittance of a Rectangular Waveguide	105
8.1.1 The General Formulation	105
8.1.2 Slot Admittance with a Negligible E_x Component	110
8.1.3 Slot Admittance with a Non-negligible E_x Component	110
8.1.4 Slot Admittance for Thick Plasma Layers	112
8.1.5 Numerical Results	114
8.1.6 Admittance Measurements	119
8.2 Mutual Admittance Between Two Rectangular Waveguides	121
8.3 Admittance of an Annular Slot	127
8.3.1 General Information	127
8.3.2 One-term Approximation of the Aperture Fields	129
8.3.3 Two-term Approximation of Aperture Fields	131
8.3.4 Radiation Conductance in Terms of Surface Fields	132
8.3.5 Slots with Free Space and Plasma Layers	133
8.3.6 Buried Slot Antennas	137
8.4 Exercises	139
8.5 References	139
9. IMPEDANCE OF LINEAR ANTENNAS IN THE PRESENCE OF A STRATIFIED DIELECTRIC	141
9.1 Driving Point Impedance of a Single Antenna	142
9.1.1 Impedance Formulation	142
9.1.2 The Free Space Impedance of a Thin Antenna	146
9.1.3 Antennas in a Homogeneous Dielectric	147
9.1.4 Antenna in Dielectric Layers	148
9.1.5 Antennas in Dielectric or Plasma Cylinders	152
9.1.6 Insulated Antennas in Dissipative Medium	155
9.2 Mutual Impedance	159
9.2.1 Impedance Formulation	159
9.2.2 Limiting Impedance Values	160
9.2.3 Free Space Impedance	161
9.2.4 Antenna in Dielectric Layers	163
9.2.5 Insulated Antennas in Dissipative Medium	165

CHAPTER	PAGE
9.3 Exercises	168
9.4 References	168
10. INSULATED LOOPS IN LOSSY MEDIA	170
10.1 Impedance Formulation	171
10.2 Loops in a Homogeneous Lossy Dielectric or in Free Space	176
10.3 Loops in Finite Layers of Lossy Dielectric	181
10.4 Exercises	185
10.5 References	185
11. ANTENNAS IN COMPRESSIBLE ISOTROPIC PLASMA	186
11.1 Guided Waves Supported by Layers of a Lossy Compressible Plasma	188
11.1.1 Field Expressions	188
11.1.2 Dispersion Relations	191
11.1.2.1 Plasma slab in free space	191
11.1.2.2 Plasma slab on a conducting plane	194
11.1.3 Numerical Results	195
11.1.4 Complex Power of Guided Waves	198
11.2 Admittance of a Waveguide Backed Slot	203
11.2.1 Field Expressions for a Two-layer Plasma	203
11.2.2 Slot Admittance	206
11.2.3 Surface Waves	208
11.2.4 Numerical Results	209
11.3 Impedance of a Linear Antenna	214
11.3.1 Impedance Formulation	215
11.3.2 Surface Waves	217
11.3.3 Impedance of a Short Antenna in an Unbounded Plasma	219
11.3.4 Numerical Results	221
11.4 Exercises	226
11.5 References	227
12. LINEAR ANTENNAS IN A MAGNETOIONIC MEDIUM	229
12.1 Cylindrical Antenna with an Axial Static Magnetic Field	232
12.1.1 Field Expressions in the Cold Electron Plasma Medium	233
12.1.2 Antenna Impedance	237
12.1.3 Impedance of a Thin Antenna Without a Dielectric Layer	238
12.1.3.1 Quasistationary approximations	239
12.1.3.2 A short antenna in a uniaxial medium	239
12.1.3.3 The half-wave antenna in free space	240
12.1.4 Discussion of Numerical Results	241
12.1.4.1 Uniaxial medium	241
12.1.4.2 Antenna resistance in a magnetoionic medium	243
12.1.4.3 Antenna impedance	244
12.1.4.4 Comparisons with other impedance calculations	249
12.2 Flat Strip Antenna with a Perpendicular Static Magnetic Field	250
12.2.1 Field Expressions in the Plasma Medium	251
12.2.2 Reflection Coefficients	254
12.2.3 Antenna Driving Point Impedance	256
12.2.4 Impedance of a Thin Antenna Without a Dielectric Layer	257
12.2.4.1 Quasistationary approximations	257
12.2.4.2 A short antenna in a uniaxial medium	259
12.2.5 Discussion of Numerical Results	261
12.2.5.1 Uniaxial medium	261
12.2.5.2 Antenna impedance for a finite magnetic field	263

CHAPTER	PAGE
12.2.5.3 Current distributions for antenna in a plasma with a finite magnetic field	266
12.2.5.4 Comparisons with other impedance calculations	268
12.2.6 Insulated Antennas Above a Ground Plane	269
12.3 Radiation from a Short Antenna in a Lossy Uniaxial Medium	271
12.3.1 Formulation of the Effective Resistance	272
12.3.2 Radiation in the Limit of Low Losses	273
12.3.3 Radiation at Large Distances in a Lossy Medium	277
12.3.4 Summary of Radiation Characteristics	278
12.4 Appendix: Strip Antenna with a Magnetic Field Perpendicular to the Axis and Parallel to the Surface	280
12.5 Exercises	283
12.6 References	283
AUTHOR INDEX	287
SUBJECT INDEX	291
OTHER TITLES IN THE SERIES	295