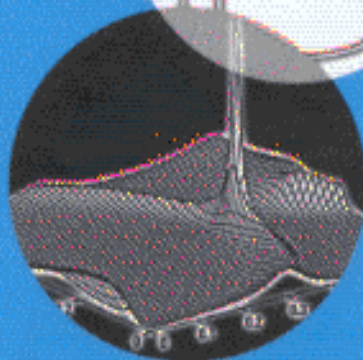
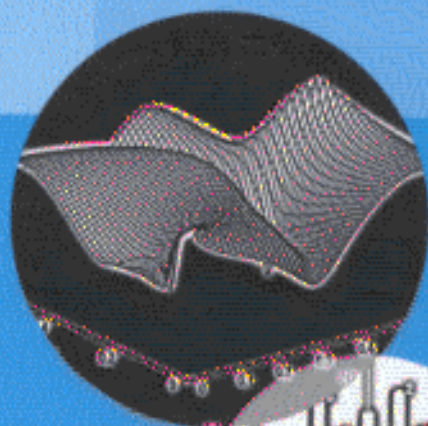


switched parasitic
antennas for cellular
communications



david v. thiel
stephanie smith

Contents

	Preface	<i>ix</i>
	Acknowledgments	<i>xi</i>
1	Smart Antennas	1
1.1	Introduction	1
1.2	Tracking Radio Sources	5
1.2.1	Beamwidth	8
1.2.2	Main Beam Scanning	8
1.2.3	Multiple Beam Scanning	12
1.2.4	Signal Identification Time	13
1.2.5	Computation Time of the Controller	14
1.3	Antenna Control Systems	14
1.3.1	One-Dimensional Tracking	16
1.3.2	Two-Dimensional Tracking	17
1.4	Summary	20
	References	21

2	Wire Antenna Theory	23
2.1	Introduction	23
2.2	Basic Radiation Theory	26
2.3	Radiation from a Wire Element	28
2.3.1	Hertzian Dipole	30
2.3.2	Short Dipole with Uniform Current	31
2.3.3	Dipole with Sinusoidal Current Distribution	32
2.3.4	Dipole with Linear Current Distribution	33
2.3.5	Impedance of Wire Antennas	35
2.4	Mutual Coupling Between Wire Elements	37
2.4.1	Side-by-Side Configuration	41
2.4.2	Collinear Configuration	44
2.5	Bandwidth of Wire Antennas	44
2.6	Wire Antennas Above a Finite Ground Plane	46
2.7	Simple Switched-Parasitic Antennas	52
2.7.1	Switched Active Antennas	52
2.7.2	Switched Parasitic Antennas	55
2.8	Wire Element Phased Arrays	59
2.9	Dual-Band Wire Antennas	64
2.10	Dual-Band Switched Parasitic Wire Antennas	71
2.11	Yagi-Uda Wire Antennas	73
2.12	Summary	75
	References	76
3	Patch Antennas	79
3.1	Radiation from a Patch Antenna	79
3.2	Mutual Coupling Between Patch Elements	96
3.3	Patch Antenna Phased Arrays	106
3.4	Stacked Patch Antennas	107

3.5	Switched Parasitic Patch Antennas	111
3.5.1	Switched Active Patch Arrays	114
3.5.2	Switched Parasitic Patch Arrays	115
3.5.3	Circularly Polarized Switched Parasitic Patch Arrays	119
3.6	Summary	122
	References	125
4	<u>Design Examples of Switched Parasitic Antennas</u>	127
4.1	Introduction	127
4.2	Historical Survey	128
4.2.1	Wire Arrays	128
4.2.2	Microstrip Arrays	140
4.3	Switched Parasitic and Switched Active Wire Arrays	144
4.3.1	Four-Element SASPA	144
4.3.2	Five-Element FASPA	149
4.4	Multibeam Wire Array	152
4.5	Switched Parasitic Patch Antennas	161
4.6	Dielectric Coated and Dielectric Resonator Antennas	166
4.6.1	Dielectric Coated Wire Antennas	171
4.6.2	Dielectric Resonator Antennas	176
4.7	Tin-Can Antenna	178
4.8	Parabolic-Antenna Beam Steering	180
4.9	Summary	184
	References	184
5	<u>Antenna Optimization</u>	189
5.1	Introduction to Optimization Methods	189
5.1.1	Cost Function	192
5.1.2	Computational Techniques	194
5.1.3	Sensitivity Analysis	195
5.1.4	Example: The Three-Element Reflector Antenna	196

5.2	Sequential Uniform Sampling	199
5.3	The Monte Carlo Method	204
5.4	The Simplex Method	208
5.5	The Gradient Method	211
5.6	Genetic Algorithm	215
5.7	Simulated Annealing	221
5.8	Summary	223
	References	228
6	Performance Limitations	231
<hr/>		
6.1	Introduction	231
6.2	Beamwidth Limits	231
6.3	Antenna Losses	233
6.3.1	Conductor Losses	233
6.3.2	Dielectric Losses	234
6.3.3	Other Losses	236
6.4	Switching Circuits for Switched Parasitic Antennas	237
6.4.1	FASPA Switches	237
6.4.2	SASPA Switches	240
6.5	New Technologies and New Applications	241
6.5.1	MEMs RF Switches	241
6.5.2	Superconductor Technology	243
6.5.3	Smart Materials and MEMs Antennas	244
6.6	Conclusions	244
	References	245
	About the Authors	247
<hr/>		
	Index	249
