

Preface	p. xv
References	p. xviii
Acknowledgments	p. xxi
Remote Sensing by Radar	p. 1
State of the Art	p. 1
Overview	p. 1
Radar Capabilities at the End of World War II	p. 6
Strip Maps and Side-Looking Radar	p. 13
Spaceborne Radar	p. 16
Surface Effects and Emerging Techniques	p. 21
Effects of Surface Characteristics	p. 21
Modern Techniques for Sensing Surface Characteristics	p. 32
References	p. 39
Basic Concepts and Definitions	p. 43
Radar Reflectivity	p. 43
The Radar Equation for Free Space	p. 44
Radar Cross Section of Targets	p. 47
Normalized Radar Cross Section	p. 48
Coherence and Incoherence of a Scattered Field	p. 50
Rayleigh Roughness Criterion, Specular Reflection, and Scattering	p. 51
Far Field of Radar Targets	p. 56
Effects of Radar Frequency Changes	p. 57
Echo Fluctuations	p. 58
The Earth and Its Effects on Radar	p. 59
Effects of the Earth's Curvature and Refraction	p. 59
The Effect of Interference on a Target	p. 63
Nature of the Sea Surface and Wind Speed Statistics	p. 66
Propagation over the Horizon	p. 70
Attenuation and Scattering by the Atmosphere	p. 73
References	p. 75
Polarization, Depolarization, and Theories of Scattering	p. 79
Polarization and Depolarization	p. 79
Polarization Scattering Matrix	p. 79
Relationships Between Linear and Circular Polarizations	p. 82
A Randomly Oriented Dipole	p. 85
A Dihedral Reflector	p. 87
Depolarization Caused by an Ensemble of Randomly Oriented Dipoles	p. 88
Theories for Radar Cross Section of Rough Surfaces	p. 91
Simple Models Including the Constant Gamma Model	p. 91
Classical Interference Theory	p. 96
The Tangent Plane Approximation	p. 97

Very Rough Surfaces	p. 97
The Facet Model	p. 98
The Slightly Rough Planar Surface	p. 98
Ripples on Water	p. 100
Vegetation Model	p. 101
Composite Surfaces	p. 103
Doppler Spectra of Sea Echo	p. 104
References	p. 106
Effects of the Earth's Surface	p. 111
Fundamental Concepts	p. 111
Effects of the Earth's Curvature and Refraction	p. 112
Reflections from a Rough, Spherical Earth	p. 115
Reflection Coefficient for a Flat, Smooth Earth	p. 118
Effect of a Flat, Smooth Earth on Target Echo	p. 125
Echo from Targets That Are Above a Flat, Smooth Earth	p. 129
Range and Depression Angle Dependencies for a Small Object Above a Smooth Earth	p. 129
Vertically Extensive Objects Above a Smooth Earth	p. 132
Propagation Factors for Circular, Horizontal, and Vertical Polarizations Above a Smooth Earth	p. 135
Propagation Factors for a Cloud of Scatterers Above a Smooth Earth	p. 138
Effects of Surface Roughness on Forward-Scattered Fields	p. 140
Reflection Coefficient for Rough Surfaces	p. 140
Shadowing	p. 145
Depolarization	p. 146
Echo from Targets That Are Above a Physically Rough Earth	p. 147
Variation of Echo Power with Range	p. 148
Range at Which Idealized R^{-4} and R^{-8} Curves Intersect	p. 150
Relative Cross Sections for Circular Polarizations	p. 150
A Cloud of Scatterers	p. 152
Effects of the Diffuse Component on Target Echo	p. 154
Multipath Effects on Echo from Land and Sea	p. 156
Effects of Multipath Interference	p. 157
Multipath Interference and Shadowing	p. 158
References	p. 159
Echo Fluctuations and Spectra	p. 163
Introduction	p. 163
Spectra and Autocorrelation Functions	p. 163
Amplitude Statistics	p. 165
Ground Echo Fluctuations	p. 172
Nature of Ground Echoes	p. 172
Temporal Amplitude Distributions for Terrain	p. 175

Spatial Amplitude Statistics	p. 182
Noncoherent Spectra and Autocorrelation Functions of Land	p. 192
Coherent Land Doppler Spectra	p. 203
Lincoln Laboratory Spectral Model	p. 211
Power in Fast and Slow Land Spectra	p. 213
Bragg Spectra from Inland Water	p. 214
Concluding Remarks on Ground Echo Fluctuations	p. 216
Visual Observations of Sea Echo	p. 219
Characteristics Revealed by an A-Scope Display	p. 219
Results from Fixed Range Sampling	p. 221
Subjective Radar/Optical Comparisons and Anomalies	p. 224
Observations of Bishop and of Lewis and Olin	p. 225
Sea Echo Statistics and Spectra	p. 228
Amplitude Distributions	p. 229
Spectra Observed with Noncoherent Radar	p. 241
Autocorrelation Functions	p. 242
Noncoherent Spectra and Relationships with Sea Surface Mechanisms	p. 248
Relative Power in Fast and Slow Fluctuations	p. 250
Phase Coherent Doppler Spectra	p. 254
Super Events	p. 267
Sea Spikes	p. 268
Concluding Remarks on Sea Echo Fluctuations and Spectra	p. 274
Space-Time Clutter Amplitude Statistics	p. 277
Compound Distributions	p. 277
The K-Distribution	p. 279
Rayleigh Modulated by Weibull Statistics	p. 281
References	p. 283
Average and Median Cross Sections	p. 291
Introduction	p. 291
General Characteristics of $[\sigma \text{ degree}]$	p. 292
Differences Between Average and Median Values	p. 294
Smooth Surfaces and Small Grazing Angles	p. 295
Classical Interference Effect	p. 299
Problems Associated with Measuring $[\sigma \text{ degree}]$	p. 301
Radar Cross Section for Land	p. 303
Nature of $[\sigma \text{ degree}]$ for Land	p. 303
Sample $[\sigma \text{ degree}]$ Land Measurements	p. 303
Terrain Within Near Vertical and Plateau Regions	p. 332
Ulaby and Dobson Tables for Terrain	p. 336
Terrain Within Plateau and Low Grazing Angle Regions	p. 340
Terrain at Extremely Low Grazing Angles	p. 345

Concluding Remarks on Average Land Echo	p. 350
Radar Cross Section for the Sea	p. 352
Nature of $[\sigma_{\text{degree}}]$ for the Sea	p. 352
Range Dependence at Small Grazing Angles	p. 354
Dependence on Grazing Angle	p. 358
Grazing Angle Dependence at Low Frequencies	p. 366
Nathanson Sea Clutter Tables	p. 372
Extremely Low Grazing Angles	p. 374
Dependence of $[\sigma_{\text{degree}}]$ on Polarization	p. 382
Dependence of $[\sigma_{\text{degree}}]$ on the Wind and Sea	p. 384
GIT Sea Clutter Models	p. 399
Wavelength Dependence for the Sea	p. 409
A Two-Scatterer Sea Clutter Model	p. 420
Oil Slicks and Rain on Water	p. 424
Concluding Remarks on Average Sea Echo	p. 425
References	p. 427
Interdependence of Polarization Characteristics	p. 435
Introduction	p. 435
General Observations	p. 435
Coherency, Statistical Independence, and Correlation	p. 437
A Simplified Polarization Model for Rough Terrain	p. 441
Use of the Polarization Model for the Moon	p. 444
Polarization Model with Different Propagation Factors	p. 450
Echo from Land, Principally Trees	p. 451
Amplitude Fluctuations	p. 452
Interdependence of Amplitude and Phase of Orthogonally Polarized Echoes	p. 453
Average and Median Value Data, and Depression Angle Dependence	p. 455
Relative Magnitude of Coherent and Incoherent Scattering from Trees	p. 459
Sea Echo	p. 463
Fluctuations of Orthogonally Polarized Components	p. 463
Averages and Medians for Linear Polarization	p. 468
Interdependence of Averages and Medians for Linear and Circular Polarizations	p. 471
Coherent and Incoherent Scattering from the Sea	p. 479
References	p. 480
Bistatic Land and Sea Clutter	p. 483
Bistatic RCS	p. 483
Effective Illuminated Area	p. 485
Depolarization and Reduction in RCS	p. 487
In-Plane ($[\phi] = 0$ and $180[\text{degree}]$) Clutter	p. 488
The Barton Model	p. 490
Ulaby et al. Indoor Measurements	p. 493

Out-of-Plane, Small Grazing Angle Data	p. 499
References	p. 502
Statistical Parameters	p. 505
Basics	p. 505
Probability Density Functions and Distributions	p. 507
Normal or Gaussian Distribution	p. 507
Rayleigh Distribution	p. 507
Ricean Distribution	p. 508
Lognormal Distribution	p. 509
Weibull Distribution	p. 510
Chi-Square, Gamma, and Weinstock Distributions	p. 511
Standard Deviation of $10 \log [\sigma]$ When $[\sigma]$ Is Rayleigh Power Distributed	p. 511
Relationship Between $10 \log([\text{characters not reproducible}]\sigma)/[\sigma \text{ subscript } m]$ and Its Variance When $[\sigma]$ Is Lognormal	p. 513
References	p. 514
About the Author	p. 515
Index	p. 517

Table of Contents provided by Blackwell's Book Services and R.R. Bowker. Used with permission.