

1. Record Nr.	UNINA9910830284003321
Autore	Persico Raffaele <1969->
Titolo	Introduction to ground penetrating radar : inverse scattering and data processing // Raffaele Persico
Pubbl/distr/stampa	Hoboken, New Jersey : , : Wiley, IEEE Press, [2014] [Piscataway, New Jersey] : , : IEEE Xplore, , [2014]
ISBN	1-118-83568-9 1-118-83564-6 1-118-83546-8
Descrizione fisica	1 online resource (400 p.)
Classificazione	TEC008000
Disciplina	621.3848 621.38485
Soggetti	Ground penetrating radar
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Description based upon print version of record.
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Foreword xiii -- Acknowledgments xvii -- About the Author xix -- Contributors xxi -- 1 INTRODUCTION TO GPR PROSPECTING 1 -- 1.1 What Is a GPR? 1 -- 1.2 GPR Systems and GPR Signals 4 -- 1.3 GPR Application Fields 5 -- 1.4 Measurement Configurations, Bands, and Polarizations 6 -- 1.5 GPR Data Processing 8 -- 2 CHARACTERIZATION OF THE HOST MEDIUM 10 -- 2.1 The Characteristics of the Host Medium 10 -- 2.2 The Measure of the Propagation Velocity in a Masonry 11 -- 2.3 The Measure of the Propagation Velocity in a Homogeneous Soil 13 -- 2.3.1 Interfacial Data in Common Offset Mode with a Null Offset: The Case of a Point-like Target 13 -- 2.3.2 Interfacial Data in Common Offset Mode with a Null Offset: The Case of a Circular Target 17 -- 2.3.3 Interfacial Data in Common Offset Mode with a Non-null Offset: The Case of a Point-like Target 18 -- 2.3.4 Noninterfacial Data in Common Offset Mode with a Null Offset: The Case of a Point-like Target 22 -- 2.3.5 Interfacial Data in Common Midpoint (CMP) Mode 25 -- 2.4 Lossy, Magnetic, and Dispersive Media 27 -- Questions 31 -- 3 GPR DATA SAMPLING: FREQUENCY AND TIME STEPS 32 -- 3.1 Stepped Frequency GPR Systems: The Problem of the Aliasing and the Frequency Step 32 -- 3.2 Shape and Thickness of the

GPR Pulses 36 -- 3.3 Stepped Frequency GPR Systems: The Problem of the Demodulation and the Frequency Step 40 -- 3.4 Aliasing and Time Step for Pulsed GPR Systems 45 -- Questions 47 -- 4 THE 2D SCATTERING EQUATIONS FOR DIELECTRIC TARGETS 48 -- 4.1 Preliminary Remarks 48 -- 4.2 Derivation of the Scattering Equations Without Considering the Effect of the Antennas 51 -- 4.3 Calculation of the Incident Field Radiated by a Filamentary Current 61 -- 4.4 The Plane Wave Spectrum of an Electromagnetic Source in a Homogeneous Space 61 -- 4.5 The Insertion of the Source Characteristics in the Scattering Equations 65 -- 4.6 The Far Field in a Homogeneous Lossless Space in Terms of Plane Wave Spectrum 69 -- 4.7 The Effective Length of an Electromagnetic Source in a Homogeneous Space 73.

4.8 The Insertion of the Receiver Characteristics in the -- Scattering Equations 75 -- Questions 77 -- 5 THE 2D SCATTERING EQUATIONS FOR MAGNETIC TARGETS 79 -- 5.1 The Scattering Equations with Only Magnetic Anomalies 79 -- 5.2 The Contribution of the x-Component of the Fitzgerald Vector 83 -- 5.3 The Contribution of the z-Component of the Fitzgerald Vector 88 -- 5.4 The Joined Contribution of Both the x- and z-Components of the Fitzgerald Vector 93 -- 5.5 The Case with Both Dielectric and Magnetic Anomalies 94 -- Questions 95 -- 6 ILL-POSEDNESS AND NONLINEARITY 96 -- 6.1 Electromagnetic Inverse Scattering 96 -- 6.2 Ill-Posedness 97 -- 6.3 Nonlinearity 97 -- 6.4 The Ill-Posedness of the Inverse Scattering Problem 100 -- 6.5 The Nonlinearity of the Inverse Scattering Problem 103 -- Questions 103 -- 7 EXTRACTION OF THE SCATTERED FIELD DATA FROM THE GPR DATA 105 -- 7.1 Zero Timing 105 -- 7.2 Muting of Interface Contributions 106 -- 7.3 The Differential Configuration 110 -- 7.4 The Background Removal 111 -- Questions 115 -- 8 THE BORN APPROXIMATION 116 -- 8.1 The Classical Born Approximation 116 -- 8.2 The Born Approximation in the Presence of Magnetic Targets 119 -- 8.3 Weak and Nonweak Scattering Objects 120 -- Questions 121 -- 9 DIFFRACTION TOMOGRAPHY 122 -- 9.1 Introduction to Diffraction Tomography 122 -- 9.2 Diffraction Tomography for Dielectric Targets 123 -- 9.3 Diffraction Tomography for Dielectric Targets Seen Under a Limited View Angle 130 -- 9.4 The Effective Maximum and Minimum View Angle 140 -- 9.5 Horizontal Resolution 142 -- 9.6 Vertical Resolution 145 -- 9.7 Spatial Step 147 -- 9.8 Frequency Step 148 -- 9.9 Time Step 149 -- 9.10 The Effect of a Non-null Height of the Observation Line 150 -- 9.11 The Effect of the Radiation Characteristics of the Antennas 156 -- 9.12 DT Relationship in the Presence of Magnetic Targets 158 -- 9.13 DT Relationship for a Differential Configuration 160 -- 9.14 DT Relationship in the Presence of Background Removal 163 -- Questions 168.

10 TWO-DIMENSIONAL MIGRATION ALGORITHMS 169 -- 10.1 Migration in the Frequency Domain 169 -- 10.2 Migration in the Time Domain (Raffaele Persico and Raffaele Solimene) 175 -- Questions 181 -- 11 THREE-DIMENSIONAL SCATTERING EQUATIONS 182 /Lorenzo Lo Monte, Raffaele Persico, and Raffaele Solimene -- 11.1 Scattering in Three Dimensions: Redefinition of the Main Symbols 182 -- 11.2 The Scattering Equations in 3D 184 -- 11.3 Three-Dimensional Green's Functions 184 -- 11.4 The Incident Field 185 -- 11.5 Homogeneous 3D Green's Functions 187 -- 11.6 The Plane Wave Spectrum of a 3D Homogeneous Green's Function 192 -- 11.7 Half-Space Green's Functions 197 -- Questions 204 -- 12 THREE-DIMENSIONAL DIFFRACTION TOMOGRAPHY 205 -- 12.1 Born Approximation and DT in 3D 205 -- 12.2 Ideal and Limited-View-Angle 3D Retrievable Spectral Sets 210 -- 12.3 Spatial Step and Transect 212 -- 12.4

Horizontal Resolution (Raffaele Persico and Raffaele Solimene) 213 --
12.5 Vertical Resolution, Frequency and Time Steps 217 -- Questions
218 -- 13 THREE-DIMENSIONAL MIGRATION ALGORITHMS 219 -- 13.1
3D Migration Formulas in the Frequency Domain 219 -- 13.2 3D
Migration Formulas in the Time Domain 222 -- 13.3 3D Versus 2D
Migration Formulas in the Time Domain 226 -- Questions 228 -- 14
THE SINGULAR VALUE DECOMPOSITION 229 -- 14.1 The Method of
Moments 229 -- 14.2 Reminders About Eigenvalues and Eigenvectors
231 -- 14.3 The Singular Value Decomposition 234 -- 14.4 The Study
of the Inverse Scattering Relationship by Means of the SVD 238 --
Questions 241 -- 15 NUMERICAL AND EXPERIMENTAL EXAMPLES 242
-- 15.1 Examples with Regard to the Measure of the Propagation
Velocity 242 -- 15.1.1 Common Offset Interfacial Data with Null Offset
on a Homogeneous Soil 242 -- 15.1.2 Common Offset Interfacial Data
on a Wall, Neglecting the Offset Between the Antennas 245 -- 15.1.3
Interfacial Common Offset Data on a Homogeneous Soil: The Effect on
the Offset Between the Antennas 247 -- 15.1.4 Noninterfacial Common
Offset Data with a Null Offset Between the Antennas 249.
15.1.5 Common Midpoint Data 250 -- 15.2 Exercises on Spatial Step
and Horizontal Resolution 252 -- 15.3 Exercises on Frequency Step
and Vertical Resolution 264 -- 15.4 Exercises on the Number of Trial
Unknowns 271 -- 15.5 Exercises on Spectral and Spatial Contents 274
-- 15.6 Exercises on the Effect of the Height of the Observation Line
280 -- 15.7 Exercises on the Effect of the Extent of the Investigation
Domain 284 -- 15.8 Exercises on the Effects of the Background
Removal 295 -- 15.9 2D and 3D Migration Examples with a Single Set
and Two Crossed Sets of B-Scans (Marcello Ciminale, Giovanni Leucci,
Loredana Matera, and Raffaele Persico) 304 -- 15.10 2D and 3D
Inversion Examples (Ilaria Catapano and Raffaele Persico) 311 --
APPENDICES 327 -- APPENDIX A (Raffaele Persico and Raffaele
Solimene) 329 -- APPENDIX B 334 -- APPENDIX C 335 -- APPENDIX D
337 -- APPENDIX E 340 -- APPENDIX F (Raffaele Persico and Raffaele
Solimene) 346 -- APPENDIX G: ANSWERS TO QUESTIONS 349 --
References 358 -- Index 365.

Sommario/riassunto

"This book presents a comprehensive treatment of ground penetrating radar using both forward and inverse scattering mathematical techniques. Use of field data instead of laboratory data enables readers to envision real-life underground imaging; a full color insert further clarifies understanding. Along with considering the practical problem of achieving interpretable underground images, this book also features significant coverage of the problem's mathematical background. This twofold approach provides a resource that will appeal both to application oriented geologists and testing specialists, and to more research-oriented physicists and engineers"--
