

1. Record Nr.	UNINA9910830156503321
Autore	Pathak P. H (Prabhakar Harihar), <1942->
Titolo	Electromagnetic radiation, scattering, and diffraction // Prabhakar H. Pathak and Robert J. Burkholder
Pubbl/distr/stampa	Hoboken, New Jersey : , : Wiley-IEEE Press, , [2021] ©2021
ISBN	1-119-81053-1 1-119-81052-3 1-119-81054-X
Descrizione fisica	1 online resource (1146 pages)
Collana	IEEE Press Series on Electromagnetic Wave Theory
Disciplina	539.2
Soggetti	Electromagnetic waves - Scattering Electromagnetic waves - Diffraction Electromagnetic waves
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Cover -- Title Page -- Copyright -- Contents -- About the Authors -- Preface -- Acknowledgments -- 1 Maxwell's Equations, Constitutive Relations, Wave Equation, and Polarization -- 1.1 Introductory Comments -- 1.2 Maxwell's Equations -- 1.3 Constitutive Relations -- 1.4 Frequency Domain Fields -- 1.5 Kramers-Kronig Relationship -- 1.6 Vector and Scalar Wave Equations -- 1.6.1 Vector Wave Equations for EM Fields -- 1.6.2 Scalar Wave Equations for EM Fields -- 1.7 Separable Solutions of the Source-Free Wave Equation in Rectangular Coordinates and for Isotropic Homogeneous Media. Plane Waves -- 1.8 Polarization of Plane Waves, Poincare Sphere, and Stokes Parameters -- 1.8.1 Polarization States -- 1.8.2 General Elliptical Polarization -- 1.8.3 Decomposition of a Polarization State into Circularly Polarized Components -- 1.8.4 Poincare Sphere for Describing Polarization States -- 1.9 Phase and Group Velocity -- 1.10 Separable Solutions of the Source-Free Wave Equation in Cylindrical and Spherical Coordinates and for Isotropic Homogeneous Media -- 1.10.1 Source-Free Cylindrical Wave Solutions -- 1.10.2 Source-Free Spherical Wave Solutions -- References -- 2 EM Boundary and Radiation Conditions --

2.1 EM Field Behavior Across a Boundary Surface -- 2.2 Radiation Boundary Condition -- 2.3 Boundary Conditions at a Moving Interface -- 2.3.1 Nonrelativistic Moving Boundary Conditions -- 2.3.2 Derivation of the Nonrelativistic Field Transformations -- 2.3.3 EM Field Transformations Based on the Special Theory of Relativity -- 2.4 Constitutive Relations for a Moving Medium -- References -- 3 Plane Wave Propagation in Planar Layered Media -- 3.1 Introduction -- 3.2 Plane Wave Reflection from a Planar Boundary Between Two Different Media -- 3.2.1 Perpendicular Polarization Case -- 3.2.2 Parallel Polarization Case -- 3.2.3 Brewster Angle θ_b . 3.2.4 Critical Angle θ_c -- 3.2.5 Plane Wave Incident on a Lossy Half Space -- 3.2.6 Doppler Shift for Wave Reflection from a Moving Mirror -- 3.3 Reflection and Transmission of a Plane Wave Incident on a Planar Stratified Isotropic Medium Using a Transmission Matrix Approach -- 3.4 Plane Waves in Anisotropic Homogeneous Media -- 3.5 State Space Formulation for Waves in Planar Anisotropic Layered Media -- 3.5.1 Development of State Space Based Field Equations -- 3.5.2 Reflection and Transmission of Plane Waves at the Interface Between Two Anisotropic Half Spaces -- 3.5.3 Transmission Type Matrix Analysis of Plane Waves in Multilayered Anisotropic Media -- References -- 4 Plane Wave Spectral Representation for EM Fields -- 4.1 Introduction -- 4.2 PWS Development -- References -- 5 Electromagnetic Potentials and Fields of Sources in Unbounded Regions -- 5.1 Introduction to Vector and Scalar Potentials -- 5.2 Construction of the Solution for -- 5.3 Calculation of Fields from Potentials -- 5.4 Time Dependent Potentials for Sources and Fields in Unbounded Regions -- 5.5 Potentials and Fields of a Moving Point Charge -- 5.6 Cerenkov Radiation -- 5.7 Direct Calculation of Fields of Sources in Unbounded Regions Using a Dyadic Green's Function -- 5.7.1 Fields of Sources in Unbounded, Isotropic, Homogeneous Media in Terms of a Closed Form Representation of Green's Dyadic, G_0 -- 5.7.2 On the Singular Nature of $G_0(\mathbf{r}, \mathbf{r}')$ for Observation Points Within the Source Region -- 5.7.3 Representation of the Green's Dyadic G_0 in Terms of an Integral in the Wavenumber (\mathbf{k}) Space -- 5.7.4 Electromagnetic Radiation by a Source in a General Bianisotropic Medium Using a Green's Dyadic G_a in \mathbf{k} -Space -- References -- 6 Electromagnetic Field Theorems and Related Topics -- 6.1 Conservation of Charge -- 6.2 Conservation of Power -- 6.3 Conservation of Momentum -- 6.4 Radiation Pressure. 6.5 Duality Theorem -- 6.6 Reciprocity Theorems and Conservation of Reactions -- 6.6.1 The Lorentz Reciprocity Theorem -- 6.6.2 Reciprocity Theorem for Bianisotropic Media -- 6.7 Uniqueness Theorem -- 6.8 Image Theorems -- 6.9 Equivalence Theorems -- 6.9.1 Volume Equivalence Theorem for EM Scattering -- 6.9.2 A Surface Equivalence Theorem for EM Scattering -- 6.9.3 A Surface Equivalence Theorem for Antennas -- 6.10 Antenna Impedance -- 6.11 Antenna Equivalent Circuit -- 6.12 The Receiving Antenna Problem -- 6.13 Expressions for Antenna Mutual Coupling Based on Generalized Reciprocity Theorems -- 6.13.1 Circuit Form of the Reciprocity Theorem for Antenna Mutual Coupling -- 6.13.2 A Mixed Circuit Field Form of a Generalized Reciprocity Theorem for Antenna Mutual Coupling -- 6.13.3 A Mutual Admittance Expression for Slot Antennas -- 6.13.4 Antenna Mutual Coupling, Reaction Concept, and Antenna Measurements -- 6.14 Relation Between Antenna and Scattering Problems -- 6.14.1 Exterior Radiation by a Slot Aperture Antenna Configuration -- 6.14.2 Exterior Radiation by a Monopole Antenna Configuration -- 6.15 Radar Cross Section -- 6.16 Antenna Directive Gain -- 6.17 Field Decomposition Theorem -- References -- 7 Modal Techniques for the Analysis of Guided Waves, Resonant Cavities, and

Periodic Structures -- 7.1 On Modal Analysis of Some Guided Wave Problems -- 7.2 Classification of Modal Fields in Uniform Guiding Structures -- 7.2.1 TEMz Guided waves -- 7.3 TMz Guided Waves -- 7.4 TEz Guided Waves -- 7.5 Modal Expansions in Closed Uniform Waveguides -- 7.5.1 TMz Modes -- 7.5.2 TEz Modes -- 7.5.3 Orthogonality of Modes in Closed Perfectly Conducting Uniform Waveguides -- 7.6 Effect of Losses in Closed Guided Wave Structures -- 7.7 Source Excited Uniform Closed Perfectly Conducting Waveguides -- 7.8 An Analysis of Some Closed Metallic Waveguides. 7.8.1 Modes in a Parallel Plate Waveguide -- 7.8.2 Modes in a Rectangular Waveguide -- 7.8.3 Modes in a Circular Waveguide -- 7.8.4 Coaxial Waveguide -- 7.8.5 Obstacles and Discontinuities in Waveguides -- 7.8.6 Modal Propagation Past a Slot in a Waveguide -- 7.9 Closed and Open Waveguides Containing Penetrable Materials and Coatings -- 7.9.1 Material-Loaded Closed PEC Waveguide -- 7.9.2 Material Slab Waveguide -- 7.9.3 Grounded Material Slab Waveguide -- 7.9.4 The Goubau Line -- 7.9.5 Circular Cylindrical Optical Fiber Waveguides -- 7.10 Modal Analysis of Resonators -- 7.10.1 Rectangular Waveguide Cavity Resonator -- 7.10.2 Circular Waveguide Cavity Resonator -- 7.10.3 Dielectric Resonators -- 7.11 Excitation of Resonant Cavities -- 7.12 Modal Analysis of Periodic Arrays -- 7.12.1 Floquet Modal Analysis of an Infinite Planar Periodic Array of Electric Current Sources -- 7.12.2 Floquet Modal Analysis of an Infinite Planar Periodic Array of Current Sources Configured in a Skewed Grid -- 7.13 Higher-Order Floquet Modes and Associated Grating Lobe Circle Diagrams for Infinite Planar Periodic Arrays -- 7.13.1 Grating Lobe Circle Diagrams -- 7.14 On Waves Guided and Radiated by Periodic Structures -- 7.15 Scattering by a Planar Periodic Array -- 7.15.1 Analysis of the EM Plane Wave Scattering by an Infinite Periodic Slot Array in a Planar PEC Screen -- 7.16 Finite 1-D and 2-D Periodic Array of Sources -- 7.16.1 Analysis of Finite 1-D Periodic Arrays for the Case of Uniform Source Distribution and Far Zone Observation -- 7.16.2 Analysis of Finite 2-D Periodic Arrays for the Case of Uniform Distribution and Far Zone Observation -- 7.16.3 Floquet Modal Representation for Near and Far Fields of 1-D Nonuniform Finite Periodic Array Distributions. 7.16.4 Floquet Modal Representation for Near and Far Fields of 2-D Nonuniform Planar Periodic Finite Array Distributions -- References -- 8 Green's Functions for the Analysis of One-Dimensional Source-Excited Wave Problems -- 8.1 Introduction to the Sturm-Liouville Form of Differential Equation for 1-D Wave Problems -- 8.2 Formulation of the Solution to the Sturm-Liouville Problem via the 1-D Green's Function Approach -- 8.3 Conditions Under Which the Green's Function Is Symmetric -- 8.4 Construction of the Green's Function $G(x|x')$ -- 8.4.1 General Procedure to Obtain $G(x|x')$ -- 8.5 Alternative Simplified Construction of $G(x|x')$ Valid for the Symmetric Case -- 8.6 On the Existence and Uniqueness of $G(x|x')$ -- 8.7 Eigenfunction Expansion Representation for $G(x|x')$ -- 8.8 Delta Function Completeness Relation and the Construction of Eigenfunctions from $G(x|x') = U(x|t -)T(x)/W$ -- 8.9 Explicit Representation of $G(x|x')$ Using Step Functions -- References -- 9 Applications of One-Dimensional Green's Function Approach for the Analysis of Single and Coupled Set of EM Source Excited Transmission Lines -- 9.1 Introduction -- 9.2 Analytical Formulation for a Single Transmission Line Made Up of Two Conductors -- 9.3 Wave Solution for the Two Conductor Lines When There Are No Impressed Sources Distributed Anywhere Within the Line -- 9.4 Wave Solution for the Case of Impressed Sources Placed Anywhere on a Two Conductor Line -- 9.5 Excitation of a Two Conductor Transmission Line

by an Externally Incident electromagnetic Wave -- 9.6 A Matrix Green's Function Approach for Analyzing a Set of Coupled Transmission Lines -- 9.7 Solution to the Special Case of Two Coupled Lines ($N = 2$) with Homogeneous Dirichlet or Neumann End Conditions -- 9.8 Development of the Multiport Impedance Matrix for a Set of Coupled Transmission Lines.
9.9 Coupled Transmission Line Problems with Voltage Sources and Load Impedances at the End Terminals.

Sommario/riassunto

"This book is designed to provide an understanding of the behavior of EM fields in radiation, scattering and guided wave environments, from first principles and from low to high frequencies. Physical interpretations of the EM wave phenomena are stressed along with their underlying mathematics. Fundamental principles are stressed, and numerous examples are included to illustrate concepts. This book can facilitate students with a somewhat limited undergraduate EM background to rapidly and systematically advance their understanding of EM wave theory that is useful and important for doing graduate level research on wave EM problems. This book can therefore also be useful for gaining a better understanding of problems they are trying to simulate with commercial EM software and how to better interpret their results. The book can also be used for self-study as a refresher for EM industry professionals"--
