

1. Record Nr.	UNINA9910632499903321
Autore	Celozzi Salvatore
Titolo	Electromagnetic Shielding : Theory and Applications
Pubbl/distr/stampa	Newark : , : John Wiley & Sons, Incorporated, , 2022 ©2022
ISBN	1-119-73631-5 1-119-73629-3
Edizione	[2nd ed.]
Descrizione fisica	1 online resource (563 pages)
Collana	Wiley Series in Microwave and Optical Engineering Ser.
Altri autori (Persone)	AraneoRodolfo BurghignoliPaolo LovatGiampiero
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	Cover -- Title Page -- Copyright -- Contents -- About the Authors -- Preface -- Chapter 1 Electromagnetics Behind Shielding -- 1.1 Definitions -- 1.2 Notation, Symbolology, and Acronyms -- 1.3 Macroscopic Electromagnetism and Maxwell's Equations -- 1.4 Constitutive Relations -- 1.5 Discontinuities and Singularities -- 1.6 Initial Conditions, Boundary Conditions, and Causality -- 1.7 Poynting's Theorem and Energy Considerations -- 1.8 Fundamental Theorems -- 1.8.1 Uniqueness Theorem -- 1.8.2 Reciprocity Theorem -- 1.8.3 Equivalence Principle -- 1.8.4 Duality -- 1.8.5 Symmetry -- 1.8.6 Image Principle -- 1.8.7 Babinet's Principle -- 1.9 Wave Equations, Helmholtz's Equations, Potentials, and Green's Functions -- 1.10 Basic Shielding Mechanisms -- 1.11 Source Inside or Outside the Shielding Structure and Reciprocity -- References -- Chapter 2 Shielding Materials -- 2.1 Standard Metallic and Ferromagnetic Materials -- 2.2 Ferrimagnetic Materials -- 2.3 Ferroelectric Materials -- 2.4 Thin Films and Conductive Coatings -- 2.5 Other Materials Suitable for EM Shielding Applications -- 2.5.1 Structural Materials -- 2.5.2 Conductive Polymers -- 2.5.3 Conductive Glasses and Transparent Materials -- 2.5.4 Conductive (and Ferromagnetic or Ferrimagnetic) Papers -- 2.6 Special Materials -- 2.6.1 Metamaterials and Chiral Materials -- 2.6.2

Composite Materials -- 2.6.3 Graphene -- 2.6.4 Other Nanomaterials -- 2.6.5 HighTemperature Superconductors -- References -- Chapter 3 Figures of Merit for Shielding Configurations -- 3.1 (Local) Shielding Effectiveness -- 3.2 The Global Point of View -- 3.3 Other Proposals of Figures of Merit -- 3.4 EnergyBased, ContentOriented Definition -- 3.5 Performance of Shielded Cables -- References -- Chapter 4 Shielding Effectiveness: Plane Waves -- 4.1 Electromagnetic Plane Waves: Definitions and Properties. 4.2 Uniform Plane Waves Incident on a Planar Shield -- 4.2.1 TransmissionLine Approach -- 4.2.2 The Single Planar Shield -- 4.2.3 Multiple (or Laminated) Shields -- 4.3 Plane Waves Normally Incident on Cylindrical Shielding Surfaces -- 4.4 Plane Waves Against Spherical Shields -- 4.5 Extension of the TL Analogy to NearField Sources -- 4.5.1 Examples -- References -- Chapter 5 Shielding Effectiveness: NearField Sources -- 5.1 SpectralDomain Approach -- 5.1.1 Maxwell's Equations in the Spectral Domain -- 5.1.2 TM/TE Decomposition and Equivalent Transmission Lines -- 5.1.3 Spectral Dyadic Green's Functions -- 5.1.4 Field Evaluation in the Spatial Domain -- 5.2 LF Magnetic Shielding of Metal Plates: Parallel Loop -- 5.2.1 Spectral Domain Approach -- 5.2.2 Vector MagneticPotential Approach -- 5.2.3 Approximate Formulations -- 5.3 LF Magnetic Shielding of Metal Plates: Perpendicular Loop -- 5.4 LF Magnetic Shielding of Metal Plates: Parallel Current Line -- References -- Chapter 6 Transient Shielding -- 6.1 Performance Parameters: Definitions and Properties -- 6.2 Transient Sources: Plane Waves and Dipoles -- 6.2.1 Transient Uniform Plane Waves -- 6.2.2 Transient Dipoles -- 6.3 Numerical Solutions via InverseFourier Transform -- 6.4 Analytical Solutions in Canonical Configurations -- 6.4.1 Transient Plane Waves on a SingleLayer Screen -- 6.4.2 Transient Dipoles: The Cagniard-de Hoop Method -- 6.4.2.1 Thin Conductive Sheet -- 6.4.2.2 Graphene Sheet -- 6.4.2.3 Generalizations: Thick Shields, Multilayered Shields -- References -- Chapter 7 Numerical Methods for Shielding Analyses -- 7.1 Finite Element Method -- 7.2 Method of Moments -- 7.3 FiniteDifference TimeDomain Method -- 7.4 Finite Integration Technique -- 7.5 TransmissionLine Matrix Method -- 7.6 Partial Element Equivalent Circuit Method -- 7.7 Test Case for Comparing Numerical Methods. References -- Chapter 8 Apertures in Planar Metal Screens -- 8.1 Historical Background -- 8.2 Statement of the Problem -- 8.3 Low Frequency Analysis: Transmission Through Small Apertures -- 8.4 The Small Circular Aperture -- 8.4.1 Bethe's Theory -- 8.4.2 Spectral Domain Formulation -- 8.5 Small Noncircular Apertures -- 8.6 Finite Number of Small Apertures -- 8.7 Apertures of Arbitrary Shape: IntegralEquation Formulation -- 8.8 Rules of Thumb -- References -- Chapter 9 Enclosures -- 9.1 Modal Expansion of Electromagnetic Fields Inside a Metallic Enclosure -- 9.2 Oscillations Inside an Ideal Source Free Enclosure -- 9.3 The Enclosure Dyadic Green Function -- 9.4 Excitation of a Metallic Enclosure -- 9.5 Damped Oscillations Inside Enclosures with Lossy Walls and Quality Factor -- 9.6 Apertures in Perfectly Conducting Enclosures -- 9.6.1 SmallAperture Approximation -- 9.6.2 Rigorous Analysis: IntegralEquation Formulation -- 9.6.3 ApertureCavity Resonances -- 9.7 Small Loading Effects -- 9.8 The Rectangular Enclosure -- 9.8.1 Symmetry Considerations -- 9.9 Shielding Effectiveness of a Rectangular Enclosure with an Aperture -- 9.9.1 Numerical Models -- 9.9.2 Analytical Models -- 9.10 Case Study: Rectangular Enclosure with a Circular Aperture -- 9.10.1 External Sources: PlaneWave Excitation -- 9.10.2 Internal Sources: Electric and Magnetic Dipole Excitations -- 9.11 Overall Performance in the Frequency Domain -- 9.12 Overall Performance in the Time Domain --

References -- Chapter 10 Cable Shielding -- 10.1 Transfer Impedance in Tubular Shielded Cables and Aperture Effects -- 10.2 Relationship Between Transfer Impedance and Shielding Effectiveness -- 10.3 Actual Cables and Harnesses -- References -- Chapter 11 Components and Installation Guidelines -- 11.1 Gaskets -- 11.2 Shielded Windows -- 11.3 Electromagnetic Absorbers -- 11.4 Shielded Connectors. 11.5 AirVentilation Systems -- 11.6 Fuses, Switches, and Other Similar Components -- References -- Chapter 12 Frequency Selective Surfaces -- 12.1 Analysis of Periodic Structures -- 12.1.1 Floquet Theorem and Spatial Harmonics -- 12.1.2 PlaneWave Incidence on a Planar 1D Periodic Structure -- 12.1.3 PlaneWave Incidence on a Planar 2D Periodic Structure -- 12.1.4 Integral Equation Formulation for Plane Wave Incidence and Periodic Green's Function -- 12.1.5 Dipole Excitation of Planar 2D Periodic Structure -- 12.2 High and LowPass FSSs -- 12.3 BandPass and BandStop FSSs -- 12.3.1 CenterConnected Elements or NPole Elements -- 12.3.2 LoopType Elements -- 12.3.3 SolidInteriorType Elements -- 12.3.4 Combinations and Fractal Elements -- 12.4 Recent Trends in FSSs -- 12.4.1 Multilayer and Cascaded FSSs -- 12.4.2 3D FSSs -- 12.4.3 2.5D FSSs -- 12.4.4 Reconfigurable and Active FSSs -- 12.5 Absorbing FSSs -- 12.5.1 Circuit Analog Absorbers -- 12.5.2 Absorptive Frequency Selective Reflection/Transmission Structures -- 12.5.2.1 AFSR Structures -- 12.5.2.2 AFST Structures (FrequencySelective Rasorbers) -- 12.6 Modeling and Design of FSSs -- References -- Chapter 13 Shielding Design Guidelines -- 13.1 Establishment of the Shielding Requirements -- 13.2 Assessment of the Number and Types of Functional Discontinuities -- 13.3 Assessment of Dimensional Constraints and NonElectromagnetic Characteristics of Materials -- 13.4 Estimation of Shielding Performance -- References -- Chapter 14 Uncommon Ways of Shielding -- 14.1 Active Shielding -- 14.2 Partial Shields -- 14.3 Chiral Shielding -- 14.4 Metamaterial Shielding -- References -- Appendix A Electrostatic Shielding -- A.1 Basic Laws of Electrostatics -- A.2 Electrostatic Tools: Electrostatic Potential and Green's Functions -- A.3 Electrostatic Shields -- A.3.1 Conductive Electrostatic Shields. A.3.2 Dielectric Electrostatic Shields -- A.3.3 Aperture Effects in Conductive Shields -- References -- Appendix B Magnetic Shielding -- B.1 Magnetic Shielding Mechanism -- B.2 Calculation Methods -- B.3 BoundaryValue Problems -- B.3.1 Spherical Magnetic Conducting Shield -- B.3.2 Cylindrical Magnetic Conducting Shield in a Transverse Magnetic Field -- B.3.3 Cylindrical Magnetic Conducting Shield in a Parallel Magnetic Field -- B.4 Ferromagnetic Shields with Hysteresis -- References -- Appendix C Statistical Electromagnetics for Shielding Enclosures -- C.1 Statistical Analyses -- C.2 Examples -- References -- Appendix D Standards and Measurement Methods for Shielding Applications -- D.1 MILSTD 285 and IEEE STD299 -- D.2 NSA 656 and NSA 94106 -- D.3 ASTM E1851 -- D.4 ASTM D4935 -- D.5 MIL STD 461G -- D.6 Code of Federal Regulations, Title 47, Part 15 -- D.7 ANSI/SCTE 483 -- D.8 MILSTD 1377 -- D.9 IEC Standards -- D.10 ITUT Recommendations -- D.11 Automotive Standards -- References -- Index -- EULA.
