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Nanotechnology"; "Contents"; "Preface"; "Chapter 1 Parallel-Processing Three-Dimensional Staggered-Grid Local-Fourier-Basis PSTD Technique"; "1.1 INTRODUCTION"; "1.2 MOTIVATION"; "1.3 LOCAL FOURIER BASIS AND OVERLAPPING DOMAIN DECOMPOSITION"; "1.4 KEY FEATURES OF THE SL-PSTD TECHNIQUE"; "1.4.1 FFT on a Local Fourier Basis"; "1.4.2 Absence of the Gibbs Phenomenon Artifact"; "1.5 TIME-STEPPING RELATIONS FOR DIELECTRIC SYSTEMS"; "1.6 ELIMINATION OF NUMERICAL PHASE VELOCITY ERROR FOR A MONOCHROMATIC EXCITATION"; "1.7 TIME-STEPPING RELATIONS WITHIN THE PERFECTLY MATCHED LAYER ABSORBING OUTER BOUNDARY"; "1.8 REDUCTION OF THE NUMERICAL ERROR IN THE NEAR-FIELD TO FAR-FIELD TRANSFORMATION"; "1.9 IMPLEMENTATION ON A DISTRIBUTED-MEMORY SUPERCOMPUTING CLUSTER"; "1.10 VALIDATION OF THE SL-PSTD TECHNIQUE"; "1.10.1 Far-Field Scattering by a Plane-Wave-Illuminated Dielectric Sphere"; "1.10.2 Far-Field Radiation from an Electric Dipole Embedded within a Double-Layered Concentric Dielectric Sphere"; "1.11 SUMMARY"; "REFERENCES"; "Chapter 2 Unconditionally Stable Laguerre Polynomial-Based FDTD Method"; "2.1 INTRODUCTION"; "2.2 FORMULATION OF THE CONVENTIONAL 3-D LAGUERRE-BASED FDTD METHOD"; "2.3 FORMULATION OF AN EFFICIENT 3-D LAGUERRE-BASED FDTD METHOD"; "2.4 PML ABSORBING BOUNDARY CONDITION"; "2.5 NUMERICAL RESULTS"; "2.5.1 Parallel-Plate Capacitor: Uniform 3-D Grid"; "2.5.2 Shielded Microstrip Line: Graded Grid in One Direction"; "2.5.3 PML Absorbing Boundary Condition Performance"; "2.6 SUMMARY AND CONCLUSIONS"; "REFERENCES"; "Chapter 3 Exact Total-Field/Scattered-Field Plane-Wave Source Condition"; "3.1 INTRODUCTION"; "3.2 DEVELOPMENT OF THE EXACT TF/SF FORMULATION FOR FDTD"; "3.3 BASIC TF/SF FORMULATION"; "3.4 ELECTRIC AND MAGNETIC CURRENT SOURCES AT THE TF/SF INTERFACE"; "3.5 INCIDENT PLANE-WAVE FIELDS IN A HOMOGENEOUS BACKGROUND MEDIUM"; "3.6 FDTD REALIZATION OF THE BASIC TF/SF FORMULATION"; "3.7 ON CONSTRUCTING AN EXACT FDTD TF/SF PLANE-WAVE SOURCE"; "3.8 FDTD DISCRETE PLANE-WAVE SOURCE FOR THE EXACT TF/SF FORMULATION"; "3.9 AN EFFICIENT INTEGER MAPPING"; "3.10 BOUNDARY CONDITIONS AND VECTOR PLANE-WAVE POLARIZATION"; "3.11 REQUIRED CURRENT DENSITIES J_{inc} AND M_{inc} "; "3.12 SUMMARY OF METHOD"; "3.13 MODELING EXAMPLES"; "3.14 DISCUSSION"; "REFERENCES"; "Chapter 4 Electromagnetic Wave Source Conditions"; "4.1 OVERVIEW"; "4.2 INCIDENT FIELDS AND EQUIVALENT CURRENTS"; "4.2.1 The Principle of Equivalence"; "4.2.2 Discretization and Dispersion of Equivalent Currents"; "4.3 SEPARATING INCIDENT AND SCATTERED FIELDS"; "4.4 CURRENTS AND FIELDS: THE LOCAL DENSITY OF STATES"

Sommario/riassunto

This book presents the current state-of-the-art in formulating and implementing computational models of light with materials such as silicon and gold at the nanoscale. Maxwell's equations are solved using the finite-difference time-domain (FDTD) technique. It will help you understand the latest developments in computational modeling of nanoscale optical microscopy and microchip lithography. You will also explore cutting-edge details in modeling nanoscale plasmonics, including nonlocal dielectric functions, molecular interactions, and multi-level semiconductor gain. Other topics include nanoscale biophotonics, especially for detecting early-stage cancers, and quantum vacuum, including the Casimir effect and blackbody radiation.

