

- **Preface**
- **1 Introduction**
- **1.1 Motivation for optical imaging**
- **1.2 General behavior of light in biological tissue**
- **1.3 Basic physics of light-matter interaction**
- **1.4 Absorption and its biological origins**
- **1.5 Scattering and its biological origins**
- **1.6 Polarization and its biological origins**
- **1.7 Fluorescence and its biological origins**
- **1.8 Image characterization**
- **1.9 References**
- **1.10 Further readings**
- **1.11 Problems**
- **2 Rayleigh Theory And Mie Theory For A Single Scatterer**
- **2.1 Introduction**
- **2.2 Summary of the Rayleigh theory**
- **2.3 Numerical example of the Rayleigh theory**
- **2.4 Summary of the Mie theory**
- **2.5 Numerical example of the Mie theory**
- **2.6 Appendix 2.A**
- **2.7 Appendix 2.B**
- **2.8 References**
- **2.9 Further readings**
- **2.10 Problems**
- **3 Monte Carlo Modeling Of Photon Transport In Biological Tissue**
- **3.1 Introduction**
- **3.2 Monte Carlo method**
- **3.3 Definition of problem**
- **3.4 Propagation of photons**
- **3.5 Physical quantities**
- **3.6 Computational examples**
- **3.7 Appendix 3.A**
- **3.8 Appendix 3.B**
- **3.9 References**
- **3.10 Further readings**
- **3.11 Problems**
- **4.3 Convolution over a Gaussian beam**
- **4 Convolution For Broadbeam Responses**
- **4.1 Introduction**
- **4.2 General formulation of convolution**
- **4.4 Convolution over a top-hat beam**
- **4.5 Numerical solution to convolution**
- **4.6 Computational examples**
- **4.7 Appendix 4.A**
- **4.8 References**
- **4.9 Further readings**

- **4.10 Problems**
- **5 Radiative Transfer Equation And Diffusion Theory**
- **5.1 Introduction**
- **5.2 Definitions of physical quantities**
- **5.3 Derivation of the radiative transport equation**
- **5.4 Diffusion theory**
- **5.5 Boundary conditions**
- **5.6 Diffuse reflectance**
- **5.7 Photon propagation regimes**
- **5.8 References**
- **5.9 Further readings**
- **5.10 Problems**
- **6 Hybrid Model Of Monte Carlo Method And Diffusion Theory**
- **6.1 Introduction**
- **6.5 Numerical computation**
- **6.2 Definition of problem**
- **6.3 Diffusion theory**
- **6.4 Hybrid model**
- **6.6 Computational examples**
- **6.7 References**
- **6.8 Further readings**
- **6.9 Problems**
- **7 Sensing Of Optical Properties And Spectroscopy**
- **7.1 Introduction**
- **7.2 Collimated transmission method**
- **7.3 Spectrophotometry**
- **7.4 Oblique-incidence reflectometry**
- **7.5 White-light spectroscopy**
- **7.6 Time-resolved measurement**
- **7.7 Fluorescence spectroscopy**
- **7.8 Fluorescence modeling**
- **7.9 References**
- **7.10 Further readings**
- **7.11 Problems**
- **8 Ballistic Imaging And Microscopy**
- **8.1 Introduction**
- **8.2 Characteristics of ballistic light**
- **8.3 Time-gated imaging**
- **8.4 Spatial-frequency filtered imaging**
- **8.5 Polarization-difference imaging**
- **8.6 Coherence-gated holographic imaging**
- **8.7 Optical heterodyne imaging**
- **8.8 Radon transformation and computed tomography**
- **8.9 Confocal microscopy**
- **8.10 Two-photon microscopy**
- **8.11 Appendix 8.A. Holography**

- **8.12 References**
- **8.13 Further readings**
- **8.14 Problems**
- **9 Optical Coherence Tomography**
- **9.1 Introduction**
- **9.2 Michelson interferometry**
- **9.3 Coherence length and coherence time**
- **9.4 Time-domain OCT**
- **9.5 Fourier-domain rapid scanning optical delay line**
- **9.6 Fourier-domain OCT**
- **9.7 Doppler OCT**
- **9.8 Group velocity dispersion**
- **9.9 Monte Carlo modeling of OCT**
- **9.10 References**
- **9.11 Further readings**
- **9.12 Problems**
- **10.1 Introduction**
- **10 Mueller Optical Coherence Tomography**