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Nota di contenuto	Title Page; Contents; Preface; Introduction; Chapter 1. Basics on Light Scattering by Particles; 1.1. Introduction; 1.2. A brief synopsis of electromagnetic theory; 1.2.1. Maxwell's equations; 1.2.2. Harmonic electromagnetic plane waves; 1.2.3. Optical constants; 1.2.4. Light scattering by a single particle; 1.3. Methods using separation of variables; 1.3.1. Lorenz-Mie (or Mie) theory; 1.3.2. Debye and complex angular momentum theories; 1.4. Rayleigh theory and the discrete dipole approximation; 1.4.1. Rayleigh theory; 1.4.2. Discrete dipole approximation; 1.5. The T-matrix method 1.6. Physical (or wave) optics models 1.6.1. Huygens-Fresnel integral; 1.6.2. Fraunhofer diffraction theory for a particle with a circular cross section; 1.6.3. Airy theory of the rainbow; 1.6.4. Marston's physical-optics approximation; 1.7. Geometrical optics; 1.7.1. Calculation of the scattering angle; 1.7.2. Calculation of the intensity of rays; 1.7.3. Calculation of the phase and amplitude of rays; 1.8. Multiple scattering and Monte Carlo models; 1.8.1. Scattering by an optically diluted

particle system; 1.8.2. Multiple scattering; 1.8.3. Monte Carlo method; 1.9. Conclusion  
1.10. Bibliography  
Chapter 2. Optical Particle Characterization; 2.1. Introduction; 2.2. Particles in flows; 2.2.1. Diameter, shape and concentration; 2.2.2. Statistical representation of particle size data; 2.2.3. Concentrations and fluxes; 2.3. An attempt to classify OPC techniques; 2.3.1. Physical principles and measured quantities; 2.3.2. Nature and procedure to achieve statistics; 2.4. Phase Doppler interferometry (or anemometry); 2.4.1. Principle; 2.4.2. Modeling the phase-diameter relationship; 2.4.3. Experimental setup and typical results; 2.4.4. Conclusion; 2.5. Ellipsometry  
2.6. Forward (or "laser") diffraction  
2.6.1. Principle; 2.6.2. Modeling and inversion of diffraction patterns; 2.6.3. Typical experimental setup and results; 2.6.4. Conclusion; 2.7. Rainbow and near-critical-angle diffractometry techniques; 2.7.1. Similarities to forward diffraction; 2.7.2. Rainbow diffractometry; 2.7.3. Near-critical-angle diffractometry; 2.8. Classical shadowgraph imaging; 2.8.1. Principle and classical setup; 2.8.2. One-dimensional shadow Doppler technique; 2.8.3. Calculation of particle images using the point spread function; 2.8.4. Conclusion  
2.9. Out-of-focus interferometric imaging  
2.9.1. Principle; 2.9.2. Modeling the diameter-angular frequency relationship; 2.9.3. Conclusion; 2.10. Holography of particles; 2.10.1. Gabor holography for holographic films; 2.10.2. Inline digital holography; 2.10.3. Conclusion; 2.11. Light extinction spectrometry; 2.11.1. Principle; 2.11.2. Algebraic inverse method; 2.11.3. Experimental setup and conclusion; 2.12. Photon correlation spectroscopy; 2.13. Laser-induced fluorescence and elastic-scattering imaging ratio; 2.13.1. Principle; 2.13.2. Experimental setup and results; 2.13.3. Conclusion  
2.14. Laser-induced incandescence

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## Sommario/riassunto

In fluid mechanics, non-intrusive measurements are fundamental in order to improve knowledge of the behavior and main physical phenomena of flows in order to further validate codes. The principles and characteristics of the different techniques available in laser metrology are described in detail in this book. Velocity, temperature and concentration measurements by spectroscopic techniques based on light scattered by molecules are achieved by different techniques: laser-induced fluorescence, coherent anti-Stokes Raman scattering using lasers and parametric sources, and absorption

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