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Laser Measurement Technology

Fundamentals and Applications

 Springer

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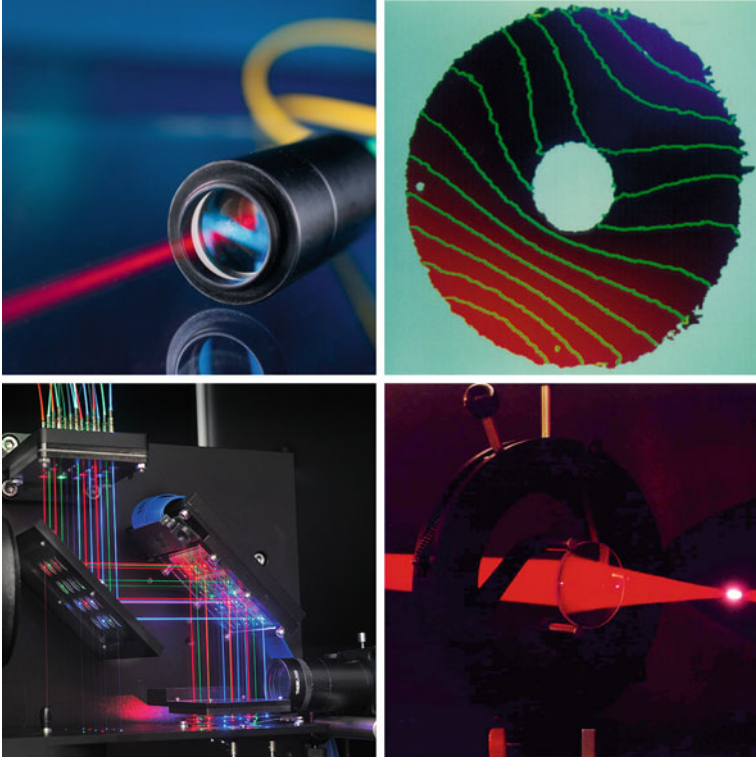
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Top left measuring head of a sensor based on optical coherence tomography. *Top right* speckle interferogram showing the out-of-plane deformation field of a measuring object. *Bottom left* multi-wavelength excitation of fluorescing particles in a microfluidic chip. *Bottom right* focusing of a nanosecond laser pulse inducing a plasma in the atmosphere at irradiances $> 10^7$ W/cm²

Preface

In the past decade, a rapid development of laser measurement technology took place. Powerful laser measuring methods are available for a variety of measuring and inspection tasks. Their applicability and benefit were demonstrated successfully for offline and inline measurements of physical and chemical quantities. The underlying dominant characteristics of laser measuring methods are simply the fact, that lasers measure without contact and with the velocity of light.

A clear trend originating in the early 1990s of the passed century becomes more and more obvious. The measuring equipment is no longer a delicate instrumentation to be operated in laboratory or measuring rooms only, but it is transferred into production facilities being installed close or even inside a production line. By this, laser measuring methods enable inline acquisition of measurands allowing for a fast insight into the process or product and thus represent the key component for closed loop concepts where the measuring information gained directly in the production line is used for prompt feedback actions to upstream or downstream process stages. In this sense, laser measurement technology creates a novel era of process transparency opening new potentials for process optimization and quality control in industry. This far-reaching potential was not accessible so far.

Scientists and engineers in research, development, and production should therefore study laser measurement technology to understand the physical principles, the set-up of laser measurement equipment and to get an overview of its application potentials.

In this book, the fundamentals of laser measurement technology are described in Chaps. 1–5, laser measuring methods and their applications are subject of Chaps. 6–14. Target audience are physicists and engineers in the job as well as students of applied physics and engineering sciences at universities. The fundamentals, methods, and applications are described to such an extent that the reader is able to track and assess future developments of laser measurement technology. The required previous knowledge is limited to the fundamentals of physics as those taught in the first semesters at universities.

The authors came in touch with laser technology in the early 1980s of the last century as doctoral candidates at the Institute for Applied Physics at the Technische Hochschule Darmstadt. Fascinated by the potentials of laser radiation they took different professional careers. A.D. moved to the educational sector and became a Professor and now dean for physics and optics at the nta Hochschule

Isny. R.N. started at the newly founded Fraunhofer Institute for Laser Technology (ILT) in Aachen and is now head of the competence area laser measurement technology and EUV sources. He has transferred various laser measurement techniques to industrial use and stimulated the foundation of new companies to develop and market new laser measurement devices. Since 2012 he is an Assistant Professor at the RWTH Aachen university. For this book, the authors bring in their comprehensive experience in teaching, research, development, and application in the field of laser measurement technology.

The authors want to express their special thanks to their wives for their patience and encouragement to enable this book project.

Isny, Aachen

Axel Donges
Reinhard Noll

Contents

1	Introduction	1
1.1	Optical Metrology and Laser Measurement Technology	1
1.2	Schematic Set-up	3
2	Properties of Laser Radiation	5
2.1	Light as Electromagnetic Wave	5
2.2	Beam Parameters	7
2.2.1	Irradiance	8
2.2.2	Phase Angle	8
2.2.3	Direction of Propagation	9
2.2.4	Wavelength	10
2.2.5	Polarization	12
2.3	Diffraction	13
2.3.1	Single Slit	14
2.3.2	Circular Aperture	16
2.3.3	Double Slit	16
2.3.4	Grating	18
2.4	Coherence	18
2.4.1	Definition of Coherence	20
2.4.2	Measurement of Temporal Coherence	21
2.4.3	Measurement of Spatial Coherence	22
2.5	Comparison of Laser Radiation and Thermal Light	24
2.6	Gaussian Beam	26
2.6.1	Description of the Gaussian Beam	27
2.6.2	Higher Transverse Modes	31
2.6.3	Beam Quality	32
2.7	Beam Parameters of Specific Laser Systems	34
2.8	Dangers of Laser Radiation	35
	References	39
3	Interaction of Laser Radiation and Matter	41
3.1	Particle Character of Light	41
3.2	Reflection and Refraction	42
3.2.1	Refractive Index	42

3.2.2	Reflection and Refraction at a Plane Interface	44
3.2.3	Reflection at Rough Surfaces	48
3.2.4	Birefringence	49
3.3	Absorption	51
3.3.1	Classical Absorption	51
3.3.2	Non-linear Absorption	53
3.3.3	Two-Photon Absorption	54
3.4	Light Scattering	55
3.4.1	Rayleigh Scattering	56
3.4.2	Mie Scattering	56
3.4.3	Raman Scattering	57
3.5	Frequency Doubling	58
3.6	Optical Doppler Effect	60
	References	61
4	Beam Shaping and Guiding	63
4.1	Optical Elements for Beam Modulation	63
4.1.1	Beam Deflection and Beam Splitting	63
4.1.2	Modulation of the Polarization	69
4.1.3	Modulation of the Intensity	74
4.1.4	Modulation of the Wavelength	76
4.1.5	Phase Shifter	77
4.2	Propagation of Gaussian Beams	80
4.2.1	<i>ABCD</i> Law	80
4.2.2	Focusing	82
4.2.3	Beam Expansion	87
4.3	Optical Fibers	89
4.3.1	Gradient-Index Fiber	89
4.3.2	Step-Index Fiber	93
4.3.3	Absorption and Dispersion of Optical Fibers	95
	References	96
5	Detection of Electromagnetic Radiation	99
5.1	Thermal Detectors	99
5.1.1	Thermocouple and Thermopile	104
5.1.2	Bolometer	105
5.1.3	Pyroelectric Detectors	108
5.2	Photoelectric Detectors	111
5.2.1	Photoelectric Cell	112
5.2.2	Photomultiplier	115
5.2.3	Channel Electron Multiplier	117
5.3	Semiconductor Detectors	118
5.3.1	Photoresistor	118
5.3.2	Photovoltaic Element and Photodiode	121

5.4	Space-Resolving Detectors.	125
5.4.1	Photographic Films.	125
5.4.2	Phase-Modulating Recording Materials.	129
5.4.3	Radiation Converter.	131
5.4.4	Image Converter.	132
5.4.5	Solid-State Image Sensors.	134
5.4.6	Lateral Effect Diode.	137
5.5	Measuring of Detector Signals.	138
5.5.1	Broadband Signals.	138
5.5.2	Impedance Conversion.	140
5.5.3	Current–Voltage Conversion.	140
5.6	Summary and Comparison.	141
	References.	142
6	Laser Interferometry.	145
6.1	Fundamentals of Interferometry.	146
6.1.1	Principle of Superposition and Complex Notation.	146
6.1.2	Principle of a Laser Interferometer.	147
6.2	Distance Measurement Using Laser Interferometers.	149
6.2.1	Polarization Interferometer.	149
6.2.2	Dual-Frequency Interferometer.	152
6.2.3	Wavelength as Length Scale.	154
6.2.4	Measuring Range and Measuring Uncertainty.	155
6.2.5	Angle Measurements.	156
6.2.6	Straightness Measurements.	158
6.2.7	Examples of Applications.	160
6.3	Twyman-Green Interferometer.	160
	References.	163
7	Holographic Interferometry.	165
7.1	Holographic Principle.	165
7.2	Principle of Holographic Interferometry.	172
7.2.1	Double-Exposure Method.	173
7.2.2	Real-Time Method.	174
7.3	Interpretation and Evaluation.	175
7.3.1	Sensitivity Vector.	175
7.3.2	Interference Fringe Patterns for Object Translation and Object Rotation.	176
7.3.3	Phase-Shifting Method.	180
7.4	Digital Holography.	182
7.4.1	Fundamentals of Digital Holography.	182
7.4.2	Digital Holographic Interferometry.	185

7.5	Set-up for Holographic Interferometry and Examples of Applications.	186
7.5.1	Measurement Set-up	186
7.5.2	Examples of Applications	189
	References	193
8	Speckle Metrology	195
8.1	Formation of Speckles.	195
8.2	Speckle Pattern Photography	198
8.2.1	Imaging Speckle Pattern Photography	198
8.2.2	Unfocused Speckle Pattern Photography	203
8.3	Speckle Interferometry	204
8.3.1	Principle	205
8.3.2	Speckle Interferometer	207
8.3.3	Electronic Speckle Interferometry.	213
8.3.4	Time-Averaged Vibration Electronic Speckle Interferometry	216
8.4	Examples of Applications	218
	References	225
9	Optical Coherence Tomography: OCT	227
9.1	Principle	227
9.1.1	Time-Domain OCT.	229
9.1.2	Fourier-Domain OCT	235
9.2	OCT Sensors	239
9.3	Examples of Applications	242
	References	244
10	Laser Triangulation	247
10.1	Principle	248
10.1.1	Scheimpflug Condition	249
10.1.2	Characteristic Curve of a Triangulation Sensor	251
10.2	Influencing Quantities in Laser Triangulation.	252
10.2.1	Laser Beam Propagation	253
10.2.2	Properties of the Object Surface.	256
10.2.3	Imaging Aberrations	259
10.2.4	Detectors and Signal Evaluation.	260
10.2.5	Atmospheric Influences.	268
10.3	Triangulation Sensors for Contour Measurement	270
10.4	Examples of Applications	273
	References	278

11 Laser Doppler Methods	279
11.1 Doppler Effect	279
11.2 Laser Vibrometer	281
11.2.1 Principle	282
11.2.2 Signal Processing	284
11.2.3 Measuring Range of Laser Vibrometers	289
11.2.4 Examples of Applications	290
11.3 Laser Doppler Anemometer	292
11.3.1 Principle	292
11.3.2 Signal Processing	296
11.3.3 Measuring Range of Laser Doppler Anemometers	299
11.3.4 Examples of Applications	300
References	302
12 Confocal Measurement Systems	305
12.1 Confocal Microscopy	305
12.1.1 Geometric Optical Analysis	305
12.1.2 Resolution	307
12.1.3 Scanners	310
12.1.4 Typical Applications of Confocal Microscopy	312
12.2 Profilometer	313
12.3 Optical Disc Scanning Systems	314
12.3.1 Optical Disc	314
12.3.2 Principle of Optical Disc Scanning	315
12.3.3 Optical Pick-up Systems	317
References	320
13 Laser Spectroscopy	323
13.1 Laser Material Analysis	324
13.1.1 Principle	324
13.1.2 Vaporization and Plasma Formation	327
13.1.3 Vaporized Material	331
13.1.4 Time-Resolved Spectroscopy	332
13.1.5 Data Evaluation	334
13.1.6 Measuring Range	335
13.1.7 Examples of Applications	336
13.2 Light Detection and Ranging: LIDAR	343
13.2.1 Principle	343
13.2.2 Differential Absorption LIDAR	348
13.2.3 Signal Processing	350
13.2.4 Measuring Range	352
13.2.5 Examples of Applications	352

13.3	Coherent Anti-Stokes Raman Spectroscopy: CARS	355
13.3.1	Principle	355
13.3.2	BOXCARS	361
13.3.3	Measuring Range	362
13.3.4	Examples of Applications	363
	References	368
14	Laser-Induced Fluorescence	373
14.1	Principle	374
14.2	Fluorescence Spectroscopy	376
14.3	Fluorescence Markers	378
14.4	Fluorescence Correlation Spectroscopy	379
14.5	Fluorescence Polarization Spectroscopy	380
14.6	Time-Resolved Fluorescence Analytics	382
14.7	Examples of Applications	383
	References	391
	Appendix A.	393
	Index	415