

Contents

Preface *IX*

References *XII*

1 A Scenic Route through the Laser 1

- 1.1 The Meaning of »Laser« 1
 - 1.2 Radiation from an Atom 9
 - 1.3 The Anatomy of a Laser 15
 - 1.4 Some Examples of Lasers 20
 - 1.5 Pulsed Lasers 34
 - 1.6 Properties of a Laser Beam 41
 - 1.7 How to Make the Shortest Laser Pulse 45
 - 1.8 Ultrashort Ultraintense Laser Pulses 61
 - 1.9 Ultrashort Ultraprecise Laser Pulses 66
 - 1.10 Ultrashort Ultrasensitive Laser Pulses 69
 - 1.11 The Nonlinear Wizard: Juggling with Frequencies 70
- References 79

2 Laser Coherence at Home 81

- 2.1 The Laser Printer 81
- 2.2 The Laser Scanner 83
- 2.3 The Laser in Data Storage 87
- 2.4 Miscellaneous Applications 90

3 The Laser in Medicine 93

- 3.1 Introduction 93
- 3.2 The Laser in Dentistry 94
- 3.3 The Laser and Vision 96
- 3.4 Lasers and the Neural Network 102
- 3.5 Lasers for the Skin and Cosmetics 104
- 3.6 Lasers in Surgery 110
- 3.7 Biostimulation Lasers for Ulcer Treatment 113

3.8	Lasers in Diagnostics	113
3.9	Ultrafast Peeking	125
	References	131
4	Lasers in Industry	133
4.1	Laser Machining	133
4.2	Laser Cutting/Drilling	134
4.3	Cutting the Forest	136
4.4	Nanostructure with Lasers	137
	References	140
5	Laser Time Capsule	141
5.1	Introduction	141
5.2	Ultrashort Pulses in Microscopy	142
5.3	Communication	144
5.4	Frequency Combs	149
	References	158
6	Light in Matter	159
6.1	Attosecond Science	161
6.2	Lasers in Nuclear Physics and Accelerators	170
6.3	Laser Cooling	177
	References	179
7	High Power Lasers (Tazer/Teaser)	181
7.1	Filaments	181
7.2	Laser-Induced Lightning	191
7.3	Laser Tazer–Teaser	198
	References	199
8	Laser Sensors	203
8.1	Passive Sensors	203
8.2	Active Sensors	217
	References	224
9	Future Perspectives	227
	References	231
	Index	232
	Color Plates	237