Content

1 Introduction 7

2 Interaction of Ultrashort Pulses with Matter 10
2.1 Physical Interaction Models 13
2.2 Phenomena with Practical Relevance 16

3 Basic Principles for the Generation of Ultrashort Laser Pulses 21
3.1 Generation and Modulation of Laser Radiation 21
3.2 Mode Coupling 27
3.3 Chirped Pulse Amplification 33
3.4 Beam Characterisation and Measurement Technology 35

4 Development of Ultrashort Pulse Lasers and Current State of the Art 42
4.1 Development History of Pulse Duration and Energy Density 42
4.2 Commercially Available Ultrashort Pulse Lasers 44
4.3 Pico vs. Femtosecond Lasers 50
4.4 Development Trends 53

5 Application Areas for Ultrashort Pulse Lasers 56
5.1 Micro Material Processing 58
5.2 Medical Technology 67
5.3 Spectroscopy 74
5.4 Special Application Areas 80

6 Conclusion and Outlook 85

7 Literature 87

8 Index 94