## Contents

Prej	face	xi
Ack	nowledgments	xiii
Ch	apter 1 Introduction	
1.1	Historical Background	1
1.2	Interaction of Light with a Two-Level System	3
1.3 1.4	The Production of Population Inversion The Threshold for Laser Oscillation	5 7
	Optical Resonators	11
	1.6 Characteristics of Laser Light	
Ch	apter 2 The CO <sub>2</sub> Laser	
2.1	Introduction	15
2.2	Axial Flow CO <sub>2</sub> Lasers	15
2.3	Electric Discharge Convection Lasers	25
2.4	Gas Dynamic Lasers	30
2.5		36
	Chemical Transfer Lasers Laser Mechanisms	54 57
4.1	Daser Internationis	37

viii Contents

Chapter 3 Detectors, Resonators, and Optical Components				
3.1	Introduction	on	73	
3.2		s Describing Detector Operation	74	
3.3				
3.4		nfrared Detectors	78	
3.5	V1			
3.6	Optical Re	sonators	110	
3.7	Modulator	S	116	
3.8	Other Opt	ical Components	124	
Ch	apter 4	Laser Heating of Solids: Theory		
4.1	Introducti	on	128	
4.2	Heat Equa	ations	129	
4.3	Basic Data	à	130	
		Ieating over the Surface Bounding a Semi-Infinite Half-Space	139	
4.5		urface Source on Semi-Infinite Half-Space	142	
		Surface Source on Semi-Infinite Half-Space	149	
4.7		eating of a Semi-Infinite Slab of Finite Thickness	155	
4.8	Composite		166	
4.9	_	the Presence of a Liquid Phase	170	
	•	on and Drilling	177	
	_	eat Sources	189	
4.12	The Valid	ity of Classical Heat Transfer Theory	198	
Ch	apter 5	Drilling		
5.1	Introducti	ion	201	
5.2	Interactio	n Mechanisms	201	
5.3	Metals		205	
	Nonmetal		210	
5.5	Thin Film	s	220	
Ch	apter 6	Welding and Machining		
6.1	Introduct	ion	232	
6.2	Microwelo		232	
6.3		on Welding	241	
6.4		S .	248	
6.5			263	
	_			

Contents						
6.6 6.7	Scribing and Controlled Fracture Micromachining	271 273				
Cha	apter 7 Applications of Laser-Induced Evaporation					
7.1 7.2 7.3 7.4 7.5 7.6 7.7	Introduction Laser Deposition of Thin Films Surface Studies The Laser Microprobe Mass Spectrometric Studies of Laser-Induced Evaporation Laser-Triggered Switching Laser Trimming of Resistors	275 276 281 282 285 290 294				
Cha	apter 8 Spectroscopy and Laser-Induced Reactions					
8.1 8.2 8.3 8.4 8.5	Introduction Laser-Induced Reactions at Surfaces Laser-Induced Reactions in the Gas Phase Spectroscopy with Infrared Lasers Isotope Separation  apter 9 Thermal Effects	298 299 304 311 319				
9.1 9.2 9.3 9.4 9.5	Introduction Measurement of Thermal Constants Metallurgical Effects Crystal Growth Stress Production	326 327 333 337 341				
Chapter 10 Propagation, Atmospheric Monitoring, and Communication Links at 10.6 $\mu$ m						
10.2 10.3 10.4 10.5	Introduction Absorption and Scattering of CO <sub>2</sub> Laser Radiation in the Atmosphere Thermally Induced Spatial and Temporal Variations in a 10.6-µm Beam Propagating through the Atmosphere Interaction of 10.6-µm Laser Radiation with Particles and Fog Dissipation Pollution Monitoring with Infrared Lasers Optical Communications Systems at 10.6 µm	352 353 359 362 368 375				

x		Contents
Appendix A	Thermal Conductivity Data	379
Appendix B	Heat Capacities	383
Appendix C	Thermal Diffusivity Data	387
References		391
Index		419