

Contents

About the Author	v
Preface	vii
Preface to the Original Edition	ix
Chapter 1 Classical Introduction	1
1-1 <i>Nonlinear Susceptibilities</i>	1
1-2 <i>Classical Atomic Models of Nonlinearity</i>	3
<i>The Free Electron Gas</i>	3
<i>The Anharmonic Oscillator</i>	5
<i>Magnetic Gyroscopes</i>	8
1-3 <i>Phenomenological Interpretation of the Nonlinear Polarization</i>	9
1-4 <i>Synopsis</i>	17
<i>References</i>	18
Chapter 2 Quantum Theory of Nonlinear Susceptibilities	20
2-1 <i>The Liouville Equation for the Density Matrix</i>	20
2-2 <i>Random Perturbations and Damping</i>	21
2-3 <i>Response to Periodic Perturbations</i>	26
2-4 <i>Lowest Order Nonlinear Conductivity</i>	31
2-5 <i>Raman-Type Nonlinearities</i>	37
2-6 <i>Higher Order Resonance Effects</i>	44
2-7 <i>Kramers-Kronig Relations</i>	45
2-8 <i>Quantization of the Fields</i>	46
<i>Nonlinear Absorption and Scattering Processes</i>	47
<i>Scattering Cross Sections and Nonlinear Susceptibilities</i>	52
<i>Coherent Quantum States, Limitation of the</i> <i>Semiclassical Treatment</i>	55
<i>Quantum Theory of Damping</i>	56
<i>References</i>	60

Chapter 3	Maxwell's Equations in Nonlinear Media	62
3-1	<i>Energy Considerations</i>	63
3-2	<i>Local Fields in Optically Dense Media</i>	68
3-3	<i>Coupled Wave Equations in Nonlinear Media</i>	70
3-4	<i>A Particular Solution for Arbitrary Nonlinear Response</i>	72
	<i>References</i>	73
Chapter 4	Wave Propagation in Nonlinear Media	74
4-1	<i>Parametric Generation and Boundary Conditions</i>	74
	<i>Anisotropic Media</i>	84
4-2	<i>Coupling Between Two Waves: Harmonic Generation</i>	85
4-3	<i>Interactions with Vibrational Waves</i>	90
	<i>Acoustic Nonlinearities</i>	90
	<i>Brillouin Scattering</i>	93
4-4	<i>Parametric Down Conversion and Oscillation</i>	96
4-5	<i>Stimulated Raman Effect</i>	102
4-6	<i>Coupling Between Stokes and Antistokes Waves</i>	110
	<i>References</i>	119
Chapter 5	Experimental Results	121
5-1	<i>Experimental Verification of the Laws of Nonlinear</i>	
	<i>Transmission and Reflection</i>	121
	<i>Geometrical Considerations</i>	122
	<i>Reflected Harmonic Waves</i>	124
	<i>Generation of Sum and Difference Frequencies</i>	127
5-2	<i>Absolute Determination of a Nonlinear Susceptibility</i>	129
5-3	<i>Multimode Structure and Fluctuation Phenomena</i>	131
5-4	<i>Nonlinear Susceptibilities of Piezoelectric Crystals</i>	134
	<i>Temperature Dependence and Dispersion of the</i>	
	<i>Nonlinear Susceptibility in KDP</i>	137
	<i>Nonlinear Susceptibilities of Semiconductors</i>	139
5-5	<i>Electric Quadrupole Effects</i>	142
5-6	<i>Third-Harmonic Generation</i>	144
5-7	<i>Multiple Photon Absorption</i>	146
5-8	<i>Intensity Dependent Index of Refraction</i>	147
5-9	<i>Stimulated Raman Effect</i>	149
5-10	<i>Higher Order Stokes and Antistokes Radiation</i>	153
5-11	<i>Raman Type Susceptibilities</i>	159
	<i>References</i>	163

Contents	xiii
Chapter 6 Conclusion	166
6-1 <i>Nonlinearities in Lasers</i>	167
6-2 <i>Other Geometries</i>	168
6-3 <i>Conclusion</i>	169
<i>References</i>	169
Epilogue	171