I. SYNTHETIC-APERTURE OPTICS

by J. W. GOODMAN (Stanford, Calif.)

1.	Introduction	3
2.	Interferometry	4
	2.1 Basic principles	4
	2.2 Image formation from interferometric data	7
	2.3 Practical difficulties in interferometric measurements	9
	2.4 Fringe detection and sensitivity	15
	2.5 Intensity interferometry	19
3.	Feedback-Controlled Optics	21
4.	Imaging with Partially Filled Apertures	26
	4.1 General properties of partially filled apertures	26
	4.2 Temporal synthesis of a filled aperture with a double-objective telescope	28
5	Aperture Synthesis with Coherent Illumination	32
0.	5.1 The active interferometer.	32
	5.2 Doppler-spread imaging	33
	5.3 Holographic arrays	34
	5.4 Optical synthetic-aperture radars	36
e		39
0.	Object Restoration beyond the Diffraction Limit	$\frac{39}{39}$
	6.1 Noiseless object restoration.	39 41
	6.2 Restoration in the presence of noise \ldots \ldots \ldots \ldots \ldots \ldots	
7.		44
	7.1 Objects restricted in polarization	45
	7.2 Objects restricted in spatial structure	45
	7.3 Temporally restricted objects	46
	7.4 Chromatically restricted objects	47
8.	Concluding Remarks	47
Acı	KNOWLEDGMENTS	47
Rei	FERENCES	48

II. THE OPTICAL PERFORMANCE OF THE HUMAN EYE

by GLENN A. FRY (Columbus, Ohio)

1.	INTRODUCTION, INVESTIGATIVE APPROACHES	3
2.	The Anatomy and Physiology of the Retina	5
3.	BASIC CONCEPTS: LINES, POINTS AND BORDERS	2
4	Marrie A	
4.	VISUAL ACUITY, RESOLVING POWER AND CONTRAST AND MODULATION SENSI-	
4.	VISUAL ACUITY, RESOLVING POWER AND CONTRAST AND MODULATION SENSI- TIVITY	6
4.	,	-
4.	ΤΙΥΙΤΥ	6

5.	SPREAD AND TRANSFER FUNCTIONS	71 71 73 74 75 80
6.	 S. 6 Index of blat	84 84 86
7.	DETERMINATION OF THE MODULATION TRANSFER FUNCTION FOR THE RE-	
	TINA	89
	7.1 Derivation from the combined function	89
	7.2 Direct measurement with a double slit interference pattern	98
8.	Perceived Modulation of a Sine-Wave Grating at Suprathreshold Levels	99
9.	DETERMINATION OF THE MODULATION TRANSFER FUNCTION OF THE OPTICAL	
	System of the Eye	100
	9.1 The Campbell-Green method	100
	9.2 The Arnulf-Dupuy method	104
10.	Resolving Power at Unit Modulation	$\frac{106}{106}$
	10.2 The effect of luminance level on resolving power	108
	10.3 Resolving power for double slit interference patterns	110
11.	Dependence of the Resolving Power on Wavelength Composition .	110
12.	VISIBILITY OF SQUARE-WAVE GRATINGS	116
	The Visibility of a Bar	120
	The Visibility of Borders	123
15.	Retinal Reflectometry	124
	Aberrations of the Eye	126
	Motor Adjustments of the Eye	127
	General Reviews	128
	PENDIX I	128
	FERENCES	129

III. LIGHT BEATING SPECTROSCOPY

by H. Z. CUMMINS and H. L. SWINNEY (Baltimore, Maryland)

1.	INTRODUCTION	$135 \\ 135 \\ 138$
2.	The Theory of Light Beating Spectroscopy	141
	2.1 Classical coherence theory	142
	2.2 Homodyne or self-beat detection	143
	2.3 Heterodyne detection	146
	2.4 Forrester's approach	147
	2.5 Quantum theory	150
3.	Light Scattering Theory	154
	3.1 Scattering by a dilute solution of particles	154
	3.1.1 Spherical scatterers	156
	3.1.2 Nonspherical scatterers	158
	3.1.3 Rigid rods.	158
	3.2 Scattering by pure fluids and liquid mixtures	159

x

	Coherence and Signal to Noise Considerations	
	4.1 Spatial coherence	;
	4.2 Source spectrum and statistics	1
	4.2.1 Phase fluctuation	;
	4.2.2 Amplitude fluctuation	•
	4.3 Light beating with a multimode laser source	
	4.4 Signal to noise	
		-
5.	Apparatus and Procedure	÷
	5.1 Homodyne spectroscopy	j.
	5.2 Heterodyne spectroscopy 188	;
6.	REVIEW OF RAYLEIGH LINEWIDTH EXPERIMENTS)
	6.1 Dilute solutions of macromolecules)
	6.2 Simple fluids near the critical point	
	6.3 Binary critical mixtures	L
	6.4 Fixman's modification	
7.	Conclusions	i.
Rei	references	,

IV. MULTILAYER ANTIREFLECTION COATINGS

by A. MUSSET and A. THELEN (Santa Rosa, Calif.)

1.	INTRODUCTION	203
2.	Single Layer Antireflection Coatings	205
3.	Two-Layer Antireflection Coatings on Glass	206
4.	The Design Method of Effective Interfaces	210
5.	Two-Layer Antireflection Coatings on High-Index Substrate	212
6.	Three-Layer Antireflection Coatings on High-Index Substrate	214
7.	Three- and Four-Layer Antireflection Coatings on Glass	217
8.	Synthesized Layers	222
9.	The Coating of Reflection Reducing Multilayers	224
10.	Environmental Stability of Multilayer Antireflection Coatings	225
11.	Optical Performance of Coatings and Increase in Transmission through an Optical System	225
12.	Photographic Applications	230
13.	Suppression of Stray Light in an Optical System	231
RE	FERENCES	236

V. STATISTICAL PROPERTIES OF LASER LIGHT

by H. RISKEN (Stuttgart)

1.	INTRODUCTION	241
2.	Semiclassical Theory	244
	2.1 Laser equations without noise.	244
	2.2 Laser equation near threshold with noise (Langevin method)	
	2.3 Laser equation with noise (Fokker-Planck equation method)	249
3.	Solution of the Laser Fokker-Planck Equation	252
	3.1 Stationary solution and its expectation values	252
	3.2 Expansion in eigenmodes.	255
	3.3 Correlation functions	256
	3.4 Transient of the laser oscillation	260

4.	Photoelectron Counting Distribution	264
	4.1 General relationships between the photoelectron distribution and in-	
	tensity distribution	264
	4.2 Counting distribution for short intervals	265
	4.3 Expectation values for arbitrary intervals	
	4.4 Condensation effect of the counting distribution	271
5.	Fully Quantum Mechanical Theory	272
	5.1 Introductory remarks	272
	5.2 Model and derivation of the laser master equation	273
	5.3 Laser master equation near threshold	279
	5.4 <i>c</i> -number equation of the laser master equation	286
Re	FERENCES	291

VI. COHERENCE THEORY OF SOURCE-SIZE COMPENSATION IN INTERFERENCE MICROSCOPY

by T. YAMAMOTO (Tokyo)

1.	Introduction	297
2.	GENERAL THEORY OF TWO-BEAM INTERFERENCE MICROSCOPES	3 00 3 00
	2.2 Localized fringes	302
	2.3 Interference microscope and source-size compensation	303
	2.4 Delay compensation	305
	2.5 Use of laser as a source for interference microscopes	305
2	Coherence Diffraction Theory of Image Formation and Two-Beam In-	
э.	TERFERENCE	306
	3.1 Steel's unified theory	306
	3.2 Extension to the polarization interferometer	311
	3.3 Shearing elements and tilting elements	312
4.		315
5.	Source-Size Compensation	317
6.	PRACTICAL METHODS OF SOURCE-SIZE COMPENSATION IN SHEARING INTER-	
	FERENCE MICROSCOPE WITH POLARIZED LIGHT	321
	6.1 Methods for obtaining fringed field of view	323
	6.2 Methods for obtaining uniform field of view	325
	6.3 Objective compensation and pupillary compensation	330
7.	IMAGES OF SOURCE-SIZE COMPENSATED INTERFERENCE MICROSCOPES	331
	7.1 Image intensity	332
	7.2 Harmonic analysis of image intensity	334
	7.3 Effects of thickness of the object under observation	336
8	Conclusion	338
		338
KE	FERENCES	338

VII. VISION IN COMMUNICATION

by L. LEVI (New York, N.Y.)

1.	Basic Concepts	345
	1.1 Problems of psychophysical investigations	
	1.2 The fundamental characteristics	346
2.	Brightness Function	
	2.1 Psychophysical measurement technique (GREEN and SWETS [1966])	
	2.2 Instantaneous brightness function	
	2.3 Steady-state brightness function.	350

хII

3. Spatial Frequency Response	351
3.1 Subsystems of the visual system	351
3.2 Optical subsystem	351
3.3 Retina-brain portion	354
3.4 Total visual system	354
3.5 Comparison of results \ldots \ldots \ldots \ldots \ldots \ldots	356
4. Noise in the Visual System	359
4.1 Threshold measurements	359
4.2 Noise sources and luminance dependence	361
4.3 Spatial spectrum of noise.	363
4.4 Amerika di etili bati en forse a constructione di antico di an	
4.4 Amplitude distribution of noise	363
4.5 Noise on the object	365
5. Shape of MTF, Linearity and Stationarity	365
5.1 Linearity of brightness function.	365
5.9 Shops of the visual met	
5.2 Shape of the visual mtf \ldots	365
5.3 Non-linearities of area effects	366
5.4 Stationarity, homogeneity, or isoplanatism	368
Acknowledgments	368
Appendix: Methods of Measuring the MTF of the Total Visual System	
	0.00
Above Threshold	368
References	370

VIII. THEORY OF PHOTOELECTRON COUNTING

by C. L. MEHTA (Rochester, N.Y.)

1. INTRODUCTION	375
2. Photoelectron Counting Formula	377
	384
3.1 Polarized thermal light.	384
3.2 Partially polarized thermal light.	391
3.3 Laser light	395
3.4 Harmonic signal mixed with thermal field	397
4. Photocounting Distribution	399
4.1 Polarized thermal light.	399
4.2 Partially polarized thermal light.	404
4.3 Laser light \ldots \ldots \ldots \ldots \ldots \ldots	406
4.4 Bunching effects	407
5. Dead Time Effects	411
5.1 General theory \ldots \ldots \ldots \ldots \ldots \ldots	411
5.2 Intensity stabilized laser light.	415
5.3 Thermal light	417
6. Multiple Correlations	418
7. Inversion Problem	423
8. Two Photon Absorption	429
Appendix A: Some Properties of Complex Gaussian Distributions	431
Appendix B: Solution of an Integral Equation	434
References	437
	-01
Author Index	441
Subject Index.	448
	±±0