

CONTENTS

PREFACE	VII
CONTENTS	IX

I. RULING, TESTING AND USE OF OPTICAL GRATINGS FOR HIGH-RESOLUTION SPECTROSCOPY

by GEORGE W. STROKE (Cambridge, Mass.)

1. INTRODUCTION	3
2. QUALITY OF GRATINGS REQUIRED FOR HIGH-RESOLUTION SPECTROSCOPY	9
2.1 Theoretical performance characteristics of perfect diffraction gratings	11
2.2 The effect of grating imperfections on the spectral quality of gratings	26
3. THE ATTAINMENT OF HIGH-RESOLUTION GRATINGS BY RULING UNDER INTERFEROMETRIC CONTROL	45
3.1 Interferometric control of grating ruling	45
3.2 Quality of gratings ruled under interferometric control	47
3.3 Adjustments of interferometers for grating-ruling control	49
3.4 Rotation control	52
3.5 Correction for the effects on the interferometric control system of barometric changes of wavelength	54
3.6 Engine temperature control	55
3.7 Diamond-carriage control	56
4. HIGH-RESOLUTION GRATINGS IN COMPARISON WITH FABRY-PEROT ETALONS IN SPECTROMETERS AND SPECTROGRAPHS	57
5. HIGH-RESOLUTION GRATING SPECTROMETERS AND SPECTROGRAPHS.	60
5.1 Spectrographs	61
5.2 Spectrometers	63
6. REPLICA GRATINGS	65
7. FURTHER IMPROVEMENTS IN THE QUALITY AND BLAZE OF DIFFRACTION GRATINGS	66
ACKNOWLEDGEMENTS	68
REFERENCES	68

II. THE METROLOGICAL APPLICATIONS OF DIFFRACTION GRATINGS

by J. M. BURCH (Teddington)

1. INTRODUCTION TO MOIRÉ FRINGE TECHNIQUES AND THEIR APPLICATIONS	
1.1 History of development	75
1.2 Information obtainable from moiré Fringes.	79

2.	THE FORMATION OF MOIRÉ FRINGE SIGNALS	83
2.1	Intensity modulation by a pair of coarse gratings	83
2.2	Fringes formed by fine gratings in a spectroscopic observing system	85
2.3	Non-spectroscopic systems using Fresnel diffraction	90
2.4	Fringes obtained with an intervening imaging system	92
2.5	Sources of measuring error	94
3.	DESIGN OF MOIRÉ FRINGE EQUIPMENT.	96
3.1	Metrological gratings and their properties	96
3.2	Visual and photoelectric reading-heads.	100
3.3	Basic methods for handling moiré fringe information	102
4.	CONCLUSION	105
	ACKNOWLEDGEMENTS	106
	LIST OF SYMBOLS	106
	REFERENCES	107

III. DIFFUSION THROUGH NON-UNIFORM MEDIA

by R. G. GIOVANELLI (Chippendale, N.S.W.)

1.	INTRODUCTION	111
2.	THE EQUATION OF RADIATIVE TRANSFER IN NON-UNIFORM MEDIA.	115
3.	MODEL PROBLEMS.	116
3.1	Infinite sinusoidal media with sources at infinity	116
3.2	Semi-infinite sinusoidal media.	117
3.3	Conservative sinusoidal-exponential media	119
4.	THE INTERPRETATION OF OBSERVATIONS	121
4.1	Radiative equilibrium, or conservative media with all sources at infinity	122
4.2	Semi-infinite media in the absence of radiative equilibrium or with gross variations.	125
5.	DISCUSSION	128
	REFERENCES	129

IV. CORRECTION OF OPTICAL IMAGES BY COMPENSATION OF ABERRATIONS AND BY SPATIAL FREQUENCY FILTERING

by JUMPEI TSUJIUCHI (Tokyo)

1.	INTRODUCTION	133
2.	CORRECTION OF ABERRANT IMAGES BY ABERRATION COMPENSATING FILTER.	134
2.1	Introduction.	134
2.2	Choice of filter	135
2.3	Effects of aberration compensation	137
2.4	Characteristics of improved images	143
2.5	Construction of filters	145
2.6	Application of the filter	149
2.7	Experiments.	151
2.8	Conclusion.	152

3.	CORRECTION OF ABERRANT IMAGES BY DOUBLE DIFFRACTION METHOD	153
3.1	Introduction.	153
3.2	Principles of the method.	153
3.3	Positive.	159
3.4	Partially negative $H(x, y)$	166
3.5	Conclusion.	175
4.	USE OF ABERRATION COMPENSATING FILTER IN DOUBLE DIFFRACTION METHOD	176
4.1	Introduction.	176
4.2	Principles.	177
4.3	Experiments and results	178
4.4	Conclusion.	179
5.	CONCLUDING REMARKS.	179
	REFERENCES.	180

V. FLUCTUATIONS OF LIGHT BEAMS

by L. MANDEL (London)

1.	HISTORICAL INTRODUCTION	183
2.	THE WAVE PICTURE OF LIGHT	187
2.1	Representation of the wave amplitude.	187
2.2	Envelope and intensity fluctuations	190
2.3	Intensity correlations in partially coherent fields	193
2.4	The effect of partial polarization	195
2.5	The spectral density of the intensity fluctuations.	200
3.	PRACTICAL APPLICATIONS OF FLUCTUATION MEASUREMENTS	201
3.1	The measurement of intensity correlation	201
3.2	Correlation between band limited signals.	205
3.3	The problem of noise	211
3.4	Stellar correlation interferometry	214
3.5	The determination of spectral line profiles	218
4.	THE PARTICLE PICTURE	222
4.1	The photon wave function in configuration space and the probability of photo-emission	222
4.2	The probability distribution of photo-electric counts	227
4.3	Correlation between counting fluctuations	231
4.4	Partially polarized light beams	233
5.	BUNCHING EFFECTS AND PHOTO-ELECTRIC COINCIDENCE EXPERIMENTS	235
	ACKNOWLEDGEMENT.	240
	APPENDICES	241
A	The connection between the correlations of the real and complex wave functions	241
B	The derivation of the distribution $p(n, T, t)$	242
	REFERENCES.	244

VI. METHODS FOR DETERMINING OPTICAL PARAMETERS OF THIN FILMS

by F. ABELÈS (Paris)

1.	INTRODUCTION	251
1.1	Definitions and notation	251
1.2	General summary of formulae for thin films	253

2.	NON-ABSORBING THIN FILMS	254
2.1	Photometric measurements	254
2.2	Polarimetric measurements	260
2.3	Interferometric measurements	263
2.4	Mixed methods	265
3.	ABSORBING THIN FILMS	267
3.1	Photometric measurements	267
3.2	Polarimetric measurements	271
3.3	Interference measurements	273
3.4	Combined methods	274
4.	VERY WEAKLY ABSORBING THIN FILMS	276
4.1	Normal incidence	276
4.2	Oblique incidence	280
5.	INHOMOGENEOUS FILMS	282
5.1	Non-absorbing, slightly inhomogeneous films	282
5.2	Inhomogeneous very thin absorbing films	283
6.	BIREFRINGENT THIN FILMS	284
7.	FINAL REMARKS	286
	ACKNOWLEDGEMENTS	287
	REFERENCES	287
	AUTHOR INDEX	289
	SUBJECT INDEX	294