

# Contents

	Page
<b>Abstract</b> .....	II
Foreword .....	III
Preface .....	IV
Editor's Note .....	V
1. Refractometry and Optical Homogeneity	
Foreword .....	xvi
Papers	
1.1. Standard conditions for precise prism refractometry, <b>Tilton, Leroy W.</b> , J. Res. NBS 14,393 (1935). Key words: Carbon dioxide; humidity; pressure; refractive index; refractometry; temperature .....	1
1.2. A precision apparatus for the rapid determination of indices of refraction and dispersion by immersion, <b>Faick, Conrad A.</b> , and <b>Fonoroff, Bernard, J.</b> Res. NBS <b>32</b> , 67 (1944). Key words: Abbe value; immersion; refractive index; <b>refractometry</b> .....	27
1.3. Refractive index of potassium bromide for infrared radiant energy, <b>Stephens, R. E.</b> , <b>Pyler, E. K.</b> , <b>Rodney,</b> <b>W. S.</b> , and <b>Spindler, R. J.</b> , J. Opt. <b>Soc. Amer.</b> 43, 110 (1953). Key words: Infrared; potassium bromide; <b>refrac-</b> <b>tive index; refractometry</b> .....	37
1.4. Relative stress-optical coefficients of some National Bureau of Standards Optical Glasses, <b>Waxler, Roy M.</b> , and <b>Napolitano, Albert, J.</b> Res. NBS 59,121 (1957). Key words: Compressive stress; birefringence; stress-optical coefficients .....	40
1.5. Rapid method for interpolating refractive index meas- urements, <b>Stravroudis, Orestes N.</b> , and <b>Sutton,</b> <b>Loyd E.</b> , J. Opt. <b>Soc. Amer.</b> 51,368 (1961). Key words: Dispersion; interpolation; refractive index refractometry- .....	45
1.6. Fitting refractive index data by least squares, <b>Sutton,</b> <b>Loyd, E.</b> , and <b>Stravroudis, Orestes N.</b> , J. Opt. <b>Soc.</b> <b>Amer.</b> 51,901 (1961). Key words: Dispersion; interpolation; refractive index; <b>refractometry</b> .....	47
1.7. Effect of pressure and temperature on the refractive indices of benzene, carbon tetrachloride, and water, <b>Waxler, R. M.</b> , and <b>Weir, C. E.</b> , J. Res. NBS—A. Phys. and Chem. <b>67A</b> , 163 (1963). Key words: Benzene; carbon tetrachloride; index; pressure; refractive index; refractometry; water-	52

# Contents

	Page
1.8. Effect of hydrostatic pressure on the refractive indices of some solids, Waxler, R. M., and Weir, C. E., <i>J. Res. NBS—A. Phys. and Chem.</i> <b>69A</b> , 325 (1965). Key words: Pressure; refractive index; <b>refractometry</b> ; solids .....	61
1.9. The performance of lenses made from inhomogeneous glasses, Rosberry, F. W., <i>Appl. Opt.</i> <b>4</b> , 21 (1965). Key words: Bubbles; inhomogeneity; lens design; <b>striae</b> .....	70
1.10. The measurement of homogeneity of optical materials in the visible and near infrared, Rosberry, F. W., <i>Appl. Opt.</i> <b>5</b> , 961 (1966). Key words: Infrared; inhomogeneity; Twyman <b>interferometer</b> .....	74
1.11. A special method for precise refractive index measurement of <b>uniaxial</b> optical media, Dodge, Marilyn J., Malitson, I. H., and Mahan, A. I., <i>Appl. Opt.</i> <b>8</b> , 1703 (1969). Key words: Refractive index; refractometry; uniaxial crystals; <b>ruby</b> .....	80
 2. Interferometry in Image Optics	
Foreword .....	84
Papers	
2.1. An apparatus for photographing interference phenomena, Saunders, James B., <i>J. Res. NBS</i> <b>35</b> , 157 (1945). Key words: Density; interferometry; photographing interference; refractive index; temperature; time; strain .....	85
2.2. Precise topography of optical surfaces, Saunders, James B., <i>J. Res. NBS</i> <b>47</b> , 148 (1951). Key words: Interferometry; measurement; topography; surface .....	119
2.3. In-line interferometer, Saunders, James B., <i>J. Opt. Soc. Amer.</i> <b>44</b> , 241 (1954). Key words: Beam dividers; in-line interferometer; interferometer; measurement; Twyman-Green <b>interferometer</b> .....	127
2.4. Testing of large optical surfaces with small test plates, Saunders, James B., <i>J. Res. NBS</i> <b>53</b> , 29 (1954). Key words: Large optics measurement; optical testing; surface; test plates; testing .....	129

# Contents

	Page
2.5. Parallel testing interferometer, Saunders, James B., J. Res. NBS 61,491 (1958). Key words: Gauge blocks; interferometer; measurement; parallel testing; parallelism; wringing (with-out)-----	135
2.6. Interferometer for large surfaces, Saunders, James B., J. Res. NBS 62,137 (1959). Key words: Interferometer; large optics; layout plates; measurement; optical testing; surface; testing-----	143
2.7. Measurement of wave fronts without a reference standard: Part 1. The wave-front-shearing interferometer, Saunders, James B., J. Res. NBS—B. Math. Phys. <b>65B</b> , 239 (1961). Key words: Converging wave front; interferometer; measurement; reference standard (without); shearing interferometer; wave front; wave-front shearing-----	146
2.8. Measurement of wave fronts without a reference standard: Part 2. The wave-front reversing interferometer, Saunders, James B., J. Res. NBS—B. Math. Phys. <b>66B</b> , 29 (1962). Key words: Converging wave front; interferometer; measurement; reference standard (without); shearing interferometer; wave front; wave-front reversing-----	153
2.9. Wave-front shearing prism interferometer, Saunders, James B., J. Res. NBS—C. Eng. and Instr. <b>68C</b> , 155 (1964). Key words: Converging wave front; interferometer; measurement; prism interferometer; reference standard (without); shearing interferometer; wave front; wave-front reversing-----	165
2.10. A simple, inexpensive wave-front-shearing interferometer, Saunders, James B., Appl. Opt. 6,1581 (1967). Key words: Converging wave-front; interferometer; measurement; prism interferometer; reference standard (without); shearing interferometer; wave front; wave-front shearing-----	182
2.11. An interferometer for measuring gradients in both refractive index and thickness of large or small optics, Saunders, J. B., J. Res. NBS—C. Eng. and Instr. <b>73C</b> , 1 (1969). Key words: Gradients; interferometer; large optics; refractive index; thickness-----	185

# Contents

	Page
<p>2.12. High-speed holographic interferometry, Funkhouser, A. T., and <b>Mielenz</b>, K. D., Appl. Opt. 9, <b>1215 (1970)</b>.            Key words: High-speed interferometry; holographic interferometry; holography; interferometry; motion analysis; vibration-----</p>	189
<p>2.13. Measurement of the second order <del>degree of</del> coherence by means of a wave-front-shearing interferometer, Grimes, D. N., Appl. Opt. <b>10, 1567 (1971)</b>.            Key words: Coherence; degree of coherence; interferometer; interferometry; partial coherence; second order degree of coherence; wave-front shearing <b>interferometer</b>-----</p>	190
3. Optical Design and Image Evaluation	
<p><b>Foreword</b>-----</p>	196
Papers	
<p>3.1. Optical Image evaluation, Proceeding of the NBS Semi-centennial Symposium, NBS Circular <b>526 (Apr. 29, 1954)</b>.            Key words: Aberration theory; aerial photography; best focus; contrast in images; diffraction image; diffraction theory of aberrations; energy distribution; evaluation of images; focus; Fresnel diffraction; image definition; image evaluation; image quality; intensity distribution; lens testing; mathematical model; optical calculations; optical image evaluation; photoelectric testing; photographic objectives; resolving power airplane-camera lenses; Ronchi test; testing; telescopes.-----</p>	197
<p>3.2. Light distribution in the image of an incoherently illuminated edge, Weinstein, W., J. Opt. <b>Soc. Amer.</b> 44, <b>610 (1954)</b>.            Key words: Diffraction; <b>edge</b>-----</p>	493
<p>3.3. Variation in distortion with magnification, <b>Magill</b>, Arthur A., J. Res. NBS 54, <b>135 (1955)</b>.            Key words: Distortion; lens testing; magnification-----</p>	499
<p>3.4. Characteristics of an image-forming system, Shack, Roland V., J. Res. NBS 56,245 <b>(1956)</b>.            Key words: Characteristics of image systems; image evaluation-----</p>	507
<p>3.5. Outline of practical characteristics of an image-forming system, Shack, Roland V., J. Opt. <b>Soc. Amer.</b> 46, <b>755 (1956)</b>.            Key words: Characteristics of image systems; image evaluation,-----</p>	523

# Contents

	Page
3.6. Evaluation of lens distortion by visual and photographic methods, Washer, Francis E., Tayman, William P., and Darling, Walter R., <i>J. Res. NBS</i> 61, 509 (1958). Key words: Aerial photography; distortion; lens testing; photographic method of lens testing; visual <b>methods</b> -----	526
3.7. Note on measurement of sine-wave response of lenses, Stephens, Robert E., <i>J. Opt. Soc. Amer.</i> 49,413 (1959). Key words: Lens testing; sine-wave response-----	533
3.8. Equipment and method for photoelectric determination of image contrast suitable for using square wave targets, Rosberry, Fred W., <i>J. Res. NBS—C. Eng. and Instr.</i> <b>64C</b> , 57 (1960). Key words: Contrast; lens testing; photoelectric lens testing; square-wave targets-----	534
3.9. Variation of resolving power and type of test pattern, Washer, Francis E., and Tayman, William P., <i>J. Res. NBS—C. Eng. and Instr.</i> <b>64C</b> , 209 (1960). Key words: Resolving power.....	542
3.10. Four-color achromats and superchromats, Stephens, R. E., <i>J. Opt. Soc. Amer.</i> 50, 1016 (1960). Key words: Color correction; four-color correction; superchromats-----	557
3.11. Magnifications of a telescope, Stephens, R. E., <i>J. Opt. Soc. Amer.</i> 51,803 (1961). Key words: Magnification; telescope-----	561
3.12. Measurement of contrast in the aerial image, Rosberry, Fred W., <i>Photogrammetric Engineering</i> , p. 155 (March 1961). Key words: Contrast; lens testing; photoelectric lens testing; square-wave targets-----	563
3.13. Location of the plane of best average definition with low contrast resolution patterns, Washer, Francis E., and Tayman, William P., <i>J. Res. NBS—C. Eng. and Instr.</i> <b>65C</b> , 195 (1961). Key words: Aerial photography; definition; focus; lens testing; low contrast targets; resolution-----	568
3.14. Comparison of lens response for sinusoidal and <b>square</b> -wave targets at several focal positions, Emara, Sayeda H., <i>J. Res. NBS—A. Phys. and Chem.</i> <b>65A</b> , 465 (1961). Key words: Focus; lens testing; sinusoidal targets--	576
3.15. Measurement of longitudinal spherical aberration in the extra-axial region of lenses, Washer, Francis E., and Darling, Walter R., <i>J. Res. NBS—C. Eng. and Instr.</i> <b>66C</b> , 185 (1962). Key words: Lens testing; spherical aberration.....	584

# Contents

	Page
3.16. Biprism method of determining the equivalent focal length of flat field lenses, Darling, Walter R., J. Res. NBS—C. Eng. and Instr. <b>66C</b> , 313 (1962). Key words: Biprism method; flat-field lenses; focal length; lens testing- -----	595
3.17. Calibration of photogrammetric lenses and cameras at the National Bureau of Standards, Washer, Francis E., Photogrammetric Engineering, p. 113 (Jan. 1963). Key words: Aerial photography; calibration distortion; camera; lens testing; photogrammetry -----	599
3.18. Determination of optical path difference for a photographic objective, Washer, Francis E., and Darling, Walter R., J. Res. NBS—C. Eng. and Instr. <b>67C</b> , 311 (1963). Key words: Aerial photography; lens testing; optical path difference; path difference; photographic objective -----	606
3.19. Experimental varification of superachromatism, Stephens, Robert E., J. Opt. <b>Soc. Amer.</b> 56,213 (1966). Key words: Color correction; four-color correction; <b>superchromats</b> -----	614
3.20. Conditions for microdensitometer linearity, Swing, Richard E., J. Opt. <b>Soc. Amer.</b> 62, 199 (1972). Key words: Coherence; image evaluation; image structure; microdensitometer; partial coherence; photographic image evaluation -----	616
3.21. Linear <b>microdensitometry</b> , Grimes, D. N., J. Opt. <b>Soc. Amer.</b> 61,1263 (1971). Key words: Coherence; image evaluation; image structure; linearity; microdensitometer; partial coherence; photographic image evaluation -----	625
3.22. Imaging of tri-bar targets and the theoretical resolution limit in partially coherent illumination, Grimes, D. N., J. Opt. <b>Soc. Amer.</b> 61,870 (1971). Key words: Image evaluation; lens testing; partial coherence; resolving power; theoretical resolution; <b>tri-bar target</b> -----	626
3.23. Optical autocorrelator with special application to MTF measurement, Grimes, D. N., Appl. Opt. 11,915 (1972). Key words: Aerial photography; autocorrelator; image evaluation; lens testing; MTF; optical autocorrelator -----	633

# Contents

	Page
4. Photographic Science	
<b>Foreword</b> -----	<b>639</b>
<b>Papers</b>	
4.1. Filters for the reproduction of sunlight and daylight and the determination of color temperature, Davis, Raymond, and Gibson, K. s., NBS Miscellaneous Publication <b>M114</b> (1931). Key words: Color conversion filters; color filters; color temperature; colorimetry; correlated color temperature; Davis-Gibson filter; daylight; filters; light filters; liquid filters; photographic sensitometry; sensitometry; standard daylight; standard lamp; standard sunlight; sunlight-----	<b>641</b>
4.2. A nomograph for selecting light balancing filters for camera exposure of color films, McCamy, C. S., Photographic Science and Engineering 3,302 (1959). Key words: Color conversion filters; color filters; color photography; color temperature; conversion filters; film; filters; light balancing filters; light filters; light source; mired filters; nomograph for color <b>filters</b> -----	<b>806</b>
4.3. Techniques for ruling and etching precise scales in glass and their reproduction by photoetching with a new light-sensitive resist, Davis, Raymond, and Pope, Chester I., NBS Circular 565 (Aug. 26,1955). Key words: Engraving; light-sensitive resist; microminiaturization; photoetching; photoresist; resist; <b>ruling</b> -----	<b>809</b>
4.4. Development of a photoresist for etching designs in glass, Pope, Chester I., and Davis, Raymond, J. Res. NBS 55,139 (1955). Key words: Engraving; light-sensitive resist; microminiaturization; photoetching; photoresist; resist; <b>ruling</b> -----	<b>847</b>
4.5. Photographic image structure evaluation, McCamy, C. S., Ultraminiaturization: Precision photography for electronic circuitry, C. R. Hance, Editor (1968), p. 131. Key words: Image evaluation; image structure; microminiaturization; photographic image <b>structure</b> ; ultraminiaturization .....	<b>851</b>
4.6. The NBS Microcopy Resolution Test Chart, Fouquet, Bernard H., Proceedings of the National Microfilm Association (1963), p. 67. Key words: Microfilming; NBS Microcopy Resolution Test Chart; resolution chart; resolving <b>power</b> ...	<b>860</b>

# Contents

	Page
4.7. The production of photographic edges of extreme sharpness, McCamy, C. S., and Berkovitz, Myron A., SPSE Conference on Frontiers of Photography, May 17–21, 1965, p. 35, Society of Photographic Scientists and Engineers. Washington, D.C. Key words: Acutance; edges; photographic edges; <b>sharpness</b> -----	868
4.8. On the information in a microphotograph, McCamy, C. S., Appl. Opt. 4,405 (1965). Key words: Film testing; image structure; information capacity; information theory; <b>microphotography</b> ; photographic image structure; resolving <b>power</b> -----	870
4.9. New principle of absolute photometry, McCamy, C. S., J. Opt. Soc. Amer. 53,511 (1963). Key words: Compensated variable aperture; <b>densitometry</b> ; photometry; reflectance; transmittance--	877
4.10. Concepts, terminology, and notation for optical modulation, McCamy, C. S., Photographic Science and Engineering 10,314, (1966). Key words: Concepts; Densitometry; notation; optical density; reflectance; reflection measurement; standardization; terminology; transmission measurement; transmittance propogance-----	878
4.11. Determination of residual thiosulfate in processed film, Pope, Chester I., J. Res. NBS—C. Eng. and Instr. 67C, 237 (1963). Key words: Archival photography; hypo; microfilming; thiosulfate-----	890
4.12. Inspection of processed photographic record films for aging blemishes, McCamy, C. S., NBS Handbook 96 (Jan. 1964). Key words: Aging blemishes; archival photography; microfilming; inspection of film; <b>redox</b> blemishes---	899
4.13. Blemish formation in processed microfilm, Pope, C. I., J. Res. Nat. Bur. Stand. (U.S.), 72A, 251 (1968). Key words: Aging blemishes; archival photography; microfilming; <b>redox</b> blemishes-----	913
4.14. A simplified method for determining residual thiosulfate in processed microfilm, Pope, C. I., Photographic Science and Engineering 13,278 (1969). Key words: Archival photography; hypo; microfilming; thiosulfate-----	922
4.15. <b>Redox</b> blemishes— Their cause and prevention, McCamy, C. S., and Pope, C. I., The Journal of Micrographics 3, 165 (1970). Key words: Aging blemishes; archival photography; inspection of film; microfilming; <b>redox</b> blemishes--	924