Contents

Series Preface xviii
Preface to the Sixth Edition xx

PART ONE  FUNDAMENTALS

1  Spectral Colour Reproduction 3
  1.1 Introduction 3
  1.2 The spectrum 3
  1.3 The micro-dispersion method of colour photography 5
  1.4 The Lippmann method 6
  1.5 Use of identical dyes 7
  1.6 Approximate spectral colour reproduction 7
  1.7 A simplified approach 7

2  Trichromatic Colour Reproduction and the Additive Principle 9
  2.1 Introduction 9
  2.2 Maxwell's method 9
  2.3 The physiology of human colour vision 10
  2.4 Spectral sensitivity curves of the retina 11
  2.5 Unwanted stimulations 13

3  Additive Methods 18
  3.1 Introduction 18
  3.2 The successive frame method 18
  3.3 The mosaic method 19
  3.4 The lenticular method 21
  3.5 The virtual-image method 23
  3.6 The diffraction method 23
  3.7 Errors in additive methods 24

4  The Subtractive Principle 25
  4.1 Introduction 25
  4.2 The subtractive principle 26
  4.3 Defects of the subtractive principle 27

5  Visual Appreciation 31
  5.1 Introduction 31
  5.2 The basis of judgement 32
  5.3 Variations of hue 33
5.4 Variations of lightness 34
5.5 Variations of colourfulness 34
5.6 Priorities 36
5.7 Factors affecting apparent colour balance 41
5.8 Integrating to grey 44
5.9 The perception of depth 45

6 Tone Reproduction 47
6.1 Introduction 47
6.2 Identical viewing conditions 47
6.3 Characteristic curves 47
6.4 Different luminance levels 48
6.5 Different surround conditions 55
6.6 Complications with solid objects 59
6.7 Comparisons of transparencies and reflection prints 59
6.8 Colourfulness 60
6.9 Exposure latitude 60
6.10 Tone reproduction in duplicating 61
6.11 Tone reproduction in television 65
6.12 Lighting geometry 65
6.13 Conclusions 65

7 The Colour Triangle 68
7.1 Introduction 68
7.2 Colour terminology 68
7.3 Trichromatic matching 70
7.4 Colour-matching functions 74
7.5 The colour triangle 78
7.6 The centre of gravity law 79
7.7 Other colour triangles 81
7.8 Additive colour reproduction 83
7.9 The Ives-Abney-Yule compromise 85
7.10 Colour gamuts of reflecting and transmitting colours 88
7.11 Two-colour reproductions 88

8 Colour Standards and Calculations 92
8.1 Introduction 92
8.2 Standard illuminants 92
8.3 The Standard Observers 94
8.4 Colour transformations 96
8.5 Properties of the XYZ system 101
8.6 Uniform chromaticity diagrams 104
8.7 Nomograms 107
8.8 Uniform colour spaces 109
8.9 Subjective effects 116
8.10 Haploscopic matching 116
## 8.11 Subjective colour scaling
- Page: 118

## 8.12 Physical colour standards
- Page: 123

## 8.13 Whiteness
- Page: 123

### 9 The Colorimetry of Subtractive Systems
- Page: 126

#### 9.1 Introduction
- Page: 126

#### 9.2 Subtractive chromaticity gamuts
- Page: 126

#### 9.3 Subtractive gamuts in the colour solid
- Page: 128

#### 9.4 Spectral sensitivities for block dyes
- Page: 132

#### 9.5 Spectral sensitivities for real dyes
- Page: 134

#### 9.6 MacAdam's analysis
- Page: 135

#### 9.7 Umberger's analysis
- Page: 135

#### 9.8 Two-colour subtractive systems
- Page: 137

#### 9.9 Subtractive quality
- Page: 138

### 10 Light Sources
- Page: 139

#### 10.1 Introduction
- Page: 139

#### 10.2 Tungsten lamps
- Page: 139

#### 10.3 Spectral-power converting filters
- Page: 142

#### 10.4 Daylight
- Page: 146

#### 10.5 Fluorescent lamps
- Page: 150

#### 10.6 Sodium, mercury, and metal-halide lamps
- Page: 151

#### 10.7 Xenon arcs
- Page: 152

#### 10.8 Carbon arcs
- Page: 154

#### 10.9 Photographic flash-bulbs
- Page: 155

#### 10.10 The red-eye effect
- Page: 155

#### 10.11 Correlated colour temperatures of commonly used light sources
- Page: 155

#### 10.12 Colour rendering of light sources
- Page: 156

#### 10.13 Visual clarity
- Page: 159

#### 10.14 Polarization
- Page: 160

#### 10.15 Light Emitting Diodes (LEDs)
- Page: 161

### 11 Objectives in Colour Reproduction
- Page: 163

#### 11.1 Introduction
- Page: 163

#### 11.2 Comparative methods
- Page: 163

#### 11.3 Absolute methods
- Page: 164

#### 11.4 Spectral colour reproduction
- Page: 164

#### 11.5 Colorimetric colour reproduction
- Page: 166

#### 11.6 Exact colour reproduction
- Page: 167

#### 11.7 Equivalent colour reproduction
- Page: 168

#### 11.8 Colorimetric colour reproduction as a practical criterion
- Page: 171

#### 11.9 Corresponding colour reproduction
- Page: 172

#### 11.10 Preferred colour reproduction
- Page: 174

#### 11.11 Degree of metamerism
- Page: 177

#### 11.12 Conclusions
- Page: 178
PART TWO  COLOUR PHOTOGRAPHY

12  Subtractive Methods in Colour Photography  183
12.1 Introduction  183
12.2 Relief images  183
12.3 Colour development  185
12.4 Integral tripacks  186
12.5 Processing with the couplers incorporated in the film  187
12.6 Reversal processing  189
12.7 Processing with the couplers in developers  190
12.8 The philosophy of colour negatives  191
12.9 Subtractive methods for amateur use in still photography  192
12.10 Subtractive methods for professional use in still photography  193
12.11 Subtractive methods for motion-picture use  194
12.12 Motion-picture frame rates  197

13  Reflection Prints in Colour  199
13.1 Introduction  199
13.2 Direct reflection-print systems  199
13.3 Reversal-reversal (positive-positive) systems  200
13.4 Negative-positive systems  200
13.5 Internegative systems  200
13.6 Printing from electronic images  201
13.7 Basic difficulties in reflection prints  201
13.8 Effect of surround  201
13.9 Inter-reflections in the image layer  201
13.10 Luminance ranges  204
13.11 Luminance levels  207
13.12 Geometry of illumination and viewing  210

14  Quantitative Colour Photography  212
14.1 Introduction  212
14.2 Sensitometric pictures  213
14.3 Sensitometric wedges  213
14.4 Uniformity of illumination  214
14.5 Exposure time  214
14.6 Light sources for sensitometry  215
14.7 Transmission colour of lenses  216
14.8 Selective exposure of layers  216
14.9 Latent image changes  216
14.10 Controlled processing  216
14.11 Visual evaluation  218
14.12 Logarithmic scales  218
14.13 Densitometers  219
14.14 Specular and diffuse transmission densities  221
14.15 Printing densities  222
14.16 Integral densities  227
14.17 Some effects of curve shape  231
## CONTENTS

14.18 Colorimetric densities 233
14.19 Spectral densities 235
14.20 Analytical densities 235
14.21 Reflection densities 237
14.22 Analytical reflection densities 237
14.23 Exposure densities 238
14.24 Scales of equal Visual increments 239
14.25 Tri-linear plots 240
14.26 Stability of dye images 240
14.27 Photographic speed 241

### 15 Masking and Coloured Couplers 244
15.1 Introduction 244
15.2 Contrast masking 244
15.3 Unsharp masking 247
15.4 Coloured couplers 247
15.5 Inter-image effects 251
15.6 Masking when making separations 253
15.7 Masking for colorimetric colour reproduction 255
15.8 Masking for approximate colour reproduction 258
15.9 Calculation of mask gammas 260

### 16 Printing Colour Negatives 262
16.1 Introduction 262
16.2 Printing studio negatives 262
16.3 Printing motion-picture negatives 263
16.4 Printing amateurs’ negatives 263
16.5 The variables to be corrected 264
16.6 Early printers 264
16.7 Integrating to grey 265
16.8 The 1599 printer 266
16.9 Variable time printers 268
16.10 Subtractive printers 268
16.11 Colour enlargers 270
16.12 Automatic classification 270
16.13 Factors affecting slope control 270
16.14 Methods of slope control 274
16.15 Electronic printing 274

### 17 The Chemistry of Colour Photography 277
17.1 Colour development 277
17.2 Developing agents 279
17.3 Couplers 281
17.4 Coloured couplers 286
17.5 The dye-coupling reaction 287
17.6 The physical form of dye images 288
17.7 Colour developing solutions 288
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.8</td>
<td>Silver bleaching</td>
<td>290</td>
</tr>
<tr>
<td>17.9</td>
<td>Processing sequences</td>
<td>290</td>
</tr>
<tr>
<td>17.10</td>
<td>Dye-bleach and dye-removal systems</td>
<td>292</td>
</tr>
<tr>
<td>17.11</td>
<td>Development-inhibitor-releasing (DIR) couplers</td>
<td>298</td>
</tr>
<tr>
<td>18.1</td>
<td>Introduction</td>
<td>300</td>
</tr>
<tr>
<td>18.2</td>
<td>Magnifications</td>
<td>300</td>
</tr>
<tr>
<td>18.3</td>
<td>Graininess and granularity</td>
<td>305</td>
</tr>
<tr>
<td>18.4</td>
<td>Granularity of silver images</td>
<td>305</td>
</tr>
<tr>
<td>18.5</td>
<td>Noise power spectra</td>
<td>307</td>
</tr>
<tr>
<td>18.6</td>
<td>Graininess in prints</td>
<td>310</td>
</tr>
<tr>
<td>18.7</td>
<td>Granularity of colour images</td>
<td>310</td>
</tr>
<tr>
<td>18.8</td>
<td>Reducing granularity of colour systems</td>
<td>316</td>
</tr>
<tr>
<td>18.9</td>
<td>Sharpness</td>
<td>317</td>
</tr>
<tr>
<td>18.10</td>
<td>Focusing</td>
<td>320</td>
</tr>
<tr>
<td>18.11</td>
<td>Depth of field</td>
<td>320</td>
</tr>
<tr>
<td>18.12</td>
<td>Modulation transfer functions</td>
<td>321</td>
</tr>
<tr>
<td>18.13</td>
<td>Photographic modulation transfer functions</td>
<td>323</td>
</tr>
<tr>
<td>18.14</td>
<td>Acutance</td>
<td>326</td>
</tr>
<tr>
<td>18.15</td>
<td>Sharpness of colour images</td>
<td>327</td>
</tr>
<tr>
<td>18.16</td>
<td>Increasing sharpness of colour films</td>
<td>329</td>
</tr>
<tr>
<td>18.17</td>
<td>Mottle on papers</td>
<td>331</td>
</tr>
<tr>
<td>18.18</td>
<td>Image structure in transfer systems</td>
<td>331</td>
</tr>
</tbody>
</table>

**PART THREE  COLOUR TELEVISION**

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.1</td>
<td>Historical introduction</td>
<td>335</td>
</tr>
<tr>
<td>19.2</td>
<td>Bandwidth</td>
<td>335</td>
</tr>
<tr>
<td>19.3</td>
<td>Interlacing</td>
<td>336</td>
</tr>
<tr>
<td>19.4</td>
<td>Single side-band transmission</td>
<td>338</td>
</tr>
<tr>
<td>19.5</td>
<td>The field sequential system</td>
<td>339</td>
</tr>
<tr>
<td>19.6</td>
<td>Blue saving</td>
<td>340</td>
</tr>
<tr>
<td>19.7</td>
<td>Band saving</td>
<td>341</td>
</tr>
<tr>
<td>19.8</td>
<td>Colour-difference signals</td>
<td>344</td>
</tr>
<tr>
<td>19.9</td>
<td>Band sharing</td>
<td>346</td>
</tr>
<tr>
<td>19.10</td>
<td>The effect of band sharing on monochrome receivers</td>
<td>348</td>
</tr>
<tr>
<td>19.11</td>
<td>Carrier sharing</td>
<td>349</td>
</tr>
<tr>
<td>19.12</td>
<td>The effects of signal processing on colour reproduction</td>
<td>350</td>
</tr>
<tr>
<td>19.13</td>
<td>Gamma correction</td>
<td>353</td>
</tr>
<tr>
<td>19.14</td>
<td>Noise reduction</td>
<td>354</td>
</tr>
<tr>
<td>19.15</td>
<td>Direct broadcasting by satellite (DBS)</td>
<td>355</td>
</tr>
<tr>
<td>19.16</td>
<td>High definition television (HDTV)</td>
<td>355</td>
</tr>
<tr>
<td>19.17</td>
<td>Signals used in video-compression systems</td>
<td>357</td>
</tr>
<tr>
<td>19.18</td>
<td>Videoconferencing</td>
<td>358</td>
</tr>
</tbody>
</table>
20 Electronic Cameras
20.1 Introduction
20.2 Early camera tubes
20.3 Tubes suitable for colour
20.4 Spectral sensitivities of television camera tubes
20.5 Charge-coupled device (CCD) sensors
20.6 Camera arrangements
20.7 Image equality in colour cameras
20.8 R-Y-B cameras
20.9 Four-sensor cameras
20.10 Automatic registration
20.11 Spectral sensitivities used in cameras
20.12 Aperture correction
20.13 Electronic news gathering (ENG)
20.14 Camcorders
20.15 Electronic still cameras

21 Display Devices for Colour Television
21.1 Introduction
21.2 The trinoscope
21.3 Triple projection
21.4 The shadow-mask tube
21.5 The Trinitron
21.6 Self-converging tubes
21.7 Light-valve projectors
21.8 Liquid crystal displays (LCDs)
21.9 Laser displays
21.10 Beam-penetration tubes
21.11 Light emitting diode (LED) displays
21.12 Plasma displays
21.13 Phosphors for additive receivers
21.14 The chromaticity of reproduced white
21.15 The luminance of reproduced white
21.16 Reflective displays

22 The N.T.S.C. and Similar Systems of Colour Television
22.1 Introduction
22.2 N.T.S.C. chromaticities
22.3 The luminance signal
22.4 \((R)(G)(B)\) to \((X)(Y)(Z)\) transformation equations
22.5 The effects of variations in chrominance-signal magnitude
22.6 The effect of gamma correction on \(E_R - E_Y\) and \(E_B - E_Y\)
22.7 The effect of gamma correction on \(E_Y\)
22.8 The P.A.L. and S.E.C.A.M. systems
22.9 The N.T.S.C. system
22.10 Blue saving in the N.T.S.C. system
22.11 Gamma correction in the N.T.S.C. system
## CONTENTS

22.12 Maximum signal amplitudes 413  
22.13 Cross-talk between $E_1'$ and $E_Q'$ 413  
22.14 The effect of the chrominance sub-carrier on the display 416  
22.16 Some useful graphical constructions 417  
22.17 Some useful equations 423

### 23 The Use of Colour Film in Colour Television 427  
23.1 Introduction 427  
23.2 Filming and televising techniques 427  
23.3 Combined film and television cameras 429  
23.4 Choice of film 429  
23.5 Deriving television signals from colour film 430  
23.6 Telecines using fast pull-down 431  
23.7 Telecines using camera-tubes 431  
23.8 Telecines giving 60 fields per second 431  
23.9 Flying-spot scanners 432  
23.10 Telecines using solid-state sensors 433  
23.11 Teletrecording 434  
23.12 Electronic adjustment of signals derived from colour film 435  
23.13 Electronic masking 436  
23.14 Overall transfer characteristics 439  
23.15 Reviewing colour films for television 441

### 24 Video Cassettes 443  
24.1 Introduction 443  
24.2 Magnetic tape 443  
24.3 Magnetic tape with helical scanning 445  
24.4 Recording on discs 447  
24.5 The Teldec system 448  
24.6 Capacitance discs 448  
24.7 Discs using lasers 448  
24.8 Photo CD 450  
24.9 The duplication of programmes on video cassettes and discs 454

### 25 Pictures from Computers 455  
25.1 Introduction 455  
25.2 Coloured captions 455  
25.3 Chroma-key 457  
25.4 Teletext 457  
25.5 Colour video display units 462  
25.6 Video graphics 462  
25.7 Computer assisted cartoons 468  
25.8 Colour coding in pictures 469  
25.9 Colour ranges 469  
25.10 Colorization and restoration of films 472
PART FOUR  COLOUR PRINTING

26  Photomechanical Principles 475
   26.1 Introduction 475
   26.2 Letterpress 475
   26.3 Lithography 481
   26.4 Gravure (Intaglio) 481
   26.5 Superimposed dye images 482
   26.6 Superimposed dot images 482
   26.7 Colorimetric colour reproduction with dot images 483
   26.8 Colour correction by masking 485
   26.9 Contact screens 485
   26.10 Autoscreen film 490
   26.11 Colour photocopying 490

27  Preparing the Copy and Checking the Results 492
   27.1 Introduction 492
   27.2 Duplicating and converting originals 493
   27.3 Duplicating transparencies 493
   27.4 Converting reflection prints to transparencies 494
   27.5 Producing second originals on paper 494
   27.6 Working from colour negatives 494
   27.7 Facsimile transmission 495
   27.8 A practical system of transparency duplication 495
   27.9 Comparing transparencies 498
   27.10 Comparing reflection prints and transparencies 499
   27.11 Prepress colour proofing 501

28  Practical Masking in Making Separations 504
   28.1 Introduction 504
   28.2 A two-mask system 504
   28.3 A four-mask system 506
   28.4 Masking procedures 506
   28.5 Special colour films for masking 507
   28.6 A direct screening system 508
   28.7 Two-stage masking 508
   28.8 Highlight masking in making separations 510
   28.9 Camera-back masking 510
   28.10 Choice of filters for making masks and separations 510
   28.11 Patches for controlling masking procedures 511
   28.12 Inks used in practice 512
   28.13 The subtractive colour triangle 514
   28.14 Standard inks 516
   28.15 Effects of printing procedures 517
   28.16 The use of extra coloured inks 517
## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>29 Colour Scanners</td>
<td>519</td>
</tr>
<tr>
<td>29.1 Introduction</td>
<td>519</td>
</tr>
<tr>
<td>29.2 The Hardy and Wurzburg scanners</td>
<td>519</td>
</tr>
<tr>
<td>29.3 The P.D.I. scanner</td>
<td>521</td>
</tr>
<tr>
<td>29.4 Other drum scanners</td>
<td>523</td>
</tr>
<tr>
<td>29.5 Other flat-bed mechanical scanners</td>
<td>523</td>
</tr>
<tr>
<td>29.6 Optical feed-back scanners</td>
<td>526</td>
</tr>
<tr>
<td>29.7 Scanners with variable magnification</td>
<td>526</td>
</tr>
<tr>
<td>29.8 Scanner outputs</td>
<td>527</td>
</tr>
<tr>
<td>29.9 Electronic retouching</td>
<td>527</td>
</tr>
<tr>
<td>29.10 Electronic page make-up</td>
<td>529</td>
</tr>
<tr>
<td>29.11 Logic circuits in scanners</td>
<td>529</td>
</tr>
<tr>
<td>29.12 Unsharp masking in scanners</td>
<td>529</td>
</tr>
<tr>
<td>29.13 Differential masking in scanners</td>
<td>529</td>
</tr>
<tr>
<td>29.14 Grey component replacement (GCR)</td>
<td>532</td>
</tr>
<tr>
<td>29.15 Under colour correction</td>
<td>532</td>
</tr>
<tr>
<td>29.16 Typical scanner signal sequences</td>
<td>532</td>
</tr>
<tr>
<td>29.17 Monitor image display</td>
<td>533</td>
</tr>
<tr>
<td>29.18 Spectral sensitivities of scanners</td>
<td>533</td>
</tr>
<tr>
<td>29.19 Calibration targets</td>
<td>536</td>
</tr>
<tr>
<td>29.20 Scanners for desktop publishing</td>
<td>540</td>
</tr>
</tbody>
</table>

**PART FIVE  DIGITAL IMAGING**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 Bit Requirements</td>
<td>545</td>
</tr>
<tr>
<td>30.1 Introduction</td>
<td>545</td>
</tr>
<tr>
<td>30.2 Tonal digitisation</td>
<td>546</td>
</tr>
<tr>
<td>30.3 Spatial digitisation</td>
<td>546</td>
</tr>
<tr>
<td>30.4 Tonal and spatial digitisation</td>
<td>547</td>
</tr>
<tr>
<td>30.5 Allowing for overall image density</td>
<td>547</td>
</tr>
<tr>
<td>30.6 Using non-linear scales for tonal digitisation</td>
<td>547</td>
</tr>
<tr>
<td>30.7 Allowing for the limited reproduction gamut</td>
<td>548</td>
</tr>
<tr>
<td>30.8 Using luminance and chrominance signals to achieve bit reduction</td>
<td>551</td>
</tr>
<tr>
<td>30.9 Allowing for the modulation transfer function of the eye</td>
<td>552</td>
</tr>
<tr>
<td>30.10 High definition television (HDTV)</td>
<td>553</td>
</tr>
<tr>
<td>30.11 Digital cinema</td>
<td>553</td>
</tr>
<tr>
<td>30.12 Conclusions</td>
<td>554</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>31 Camcorders and Digital Still Cameras</td>
<td>555</td>
</tr>
<tr>
<td>31.1 Introduction</td>
<td>555</td>
</tr>
<tr>
<td>31.2 Filter arrays</td>
<td>555</td>
</tr>
<tr>
<td>31.3 Memory</td>
<td>556</td>
</tr>
<tr>
<td>31.4 Spectral sensitivities</td>
<td>556</td>
</tr>
<tr>
<td>31.5 Speed</td>
<td>557</td>
</tr>
<tr>
<td>31.6 Numbers of pixels</td>
<td>557</td>
</tr>
<tr>
<td>31.7 Electronic camera flow chart</td>
<td>558</td>
</tr>
<tr>
<td>31.8 Digital still camera signal processing</td>
<td>559</td>
</tr>
</tbody>
</table>
31.9 White balance in electronic cameras 561
31.10 A proposed standard default colour space, sRGB 562

32 Digital Scanners 564
32.1 Introduction 564
32.2 Scanning Methods 564
32.3 Light sources 565
32.4 Detectors 565
32.5 Obtaining the red, green, and blue signals 565
32.6 Colorimetry 565
32.7 Scanner targets 566
32.8 Spatial resolution 567
32.9 Tonal resolution 567

33 Digital Printing 569
33.1 Introduction 569
33.2 Number of tone levels required 569
33.3 Dot gain 570
33.4 Comparison of visual, continuous tone, half-tone, and micro-dot resolutions 572
33.5 Digital proofing 573
33.6 Desktop printing methods 573
33.7 Photographic imaging 574
33.8 Laser electrophotography 574
33.9 Thermal dye transfer 575
33.10 Thermal wax transfer 576
33.11 Ink jet 578
33.12 Hybrid continuous-tone and half-tone systems 579
33.13 Colour management systems 579
33.14 Device dependency 580
33.15 Viewing conditions 580
33.16 Gamut mapping 581
33.17 Device stability 582
33.18 Electronic image enhancement 583
33.19 Glossary of terms used in desktop printing 583

PART SIX EVALUATING COLOUR APPEARANCE 589

34 Chromatic Adaptation Transforms and a Colour Inconstancy Index 589
34.1 Introduction 589
34.2 Illuminant colorimetric shift 589
34.3 Adaptive colour shift 589
34.4 Chromatic adaptation transforms 590
34.5 The 1997 chromatic adaptation transform (CAT97) 591
34.6 The 1997 colour inconstancy index (CON97) 592
34.7 Reversing the 1997 chromatic adaptation transform (CAT97) 594
CONTENTS

35 CIECAM97s Model of Colour Appearance
35.1 Introduction
35.2 Visual areas in the observing field
35.3 Chromatic adaptation
35.4 Spectral sensitivities of the cones
35.5 Cone response functions
35.6 Luminance adaptation
35.7 Criteria for achromacy and for constant hue
35.8 Effects of luminance adaptation
35.9 Criteria for unique hues
35.10 Redness-greenness, a, and yellowness-blueness, b
35.11 Hue angle, h
35.12 Correlate of saturation, s
35.13 Correlates of hue, H and HC
35.14 Comparison with the Natural Colour System (NCS)
35.15 The achromatic response, A
35.16 Correlate of lightness, J
35.17 Correlate of brightness, Q
35.18 Correlates of chroma, C, and colourfulness, M
35.19 Testing model CIECAM97s
35.20 Filtration of projected slides
35.21 Effect of screen luminance on quality of projected pictures
35.22 Steps for using the CIECAM97s model
35.23 Steps for using the CIECAM97s model in reverse mode
35.24 Worked example for the model CIECAM97s
35.25 Using reversed colour models

36 Models of Colour Vision for Comprehensive Purposes and for Unrelated Colours
36.1 Introduction
36.2 Steps for using the 1997 comprehensive colour appearance model, CAM97c
36.3 Reversing the 1997 comprehensive colour appearance model, CAM97u
36.4 Unrelated colours, model CAM97u
36.5 Steps involved in using the model CAM97u for unrelated colours

37 Colour Reproduction Indices
37.1 Introduction
37.2 Steps in using a colour reproduction index
37.3 Using the colour reproduction index in practice

APPENDICES

Appendix 1 Matrix Algebra
A1.1 General principles
A1.2 Application to colorimetry
Appendix 2  Colorimetric Tables  
A2.1  Calculating colorimetric measures  
A2.2  Formulae and tables  

Appendix 3  Photometric Units  
A3.1  Relations between units of luminance  
A3.2  Relations between units of luminance and illumination  
A3.3  Some useful conversion factors  
A3.4  Typical levels of luminance and illumination  
A3.5  Typical levels of illumination from projectors  

Appendix 4  Photographic Parameters  
A4.1  Film speeds  
A4.2  Film dimensions  
A4.3  Motion picture parameters  
A4.4  Lens apertures  
A4.5  Flash guide numbers  

Appendix 5  Advanced Colour Difference Formulae  
A5.1  Introduction  
A5.2  CIE 94 colour difference formula  
A5.3  CMC (l:c) colour difference formula  
A5.4  CIEDE2000 colour difference formula  

Appendix 6  A Replacement for CIECAM97s  
A6.1  Introduction  
A6.2  Forward model  
A6.3  Reverse model  
A6.4  Worked example  

Appendix 7  Spectral Luminous Efficiency Functions  

Index