

## Index

### *a*

- active thermal imaging 327
  - lock-in thermography 337
  - nondestructive testing of composites 340
  - pulse thermography 333
  - pulsed phase thermography 345
  - solar cell inspection 343
  - thermal waves 330
- adiabatic processes 417
- air mass 744
- airplanes 676
- ambient temperature 143
- animals 721
  - bees 727
  - grizzly bear 729
  - humming bird 726
  - pets 722
  - zoo animals 723
- antireflection coatings 65
- arts 735
  - contemporary dance 737
  - musical instruments 735
  - paintings 740
- atmospheric emission 143, 742
- atmospheric temperature 143
- atmospheric transmission 53, 143, 691, 742
- attenuation/transmission of IR radiation 50
  - absorbing slabs 55
  - nonabsorbing slabs 54
- automobile industry 670
  - heating systems 671
  - Night Vision in 672
- autoshutter 183

### *b*

- Background Noise Limited Detection 120
- background reflections 155
- bad pixels 186
- Biot number 361

- blackbody calibration standards 45
- blackbody radiation 21
  - band emission 26
  - Planck's law 22
  - Stefan–Boltzmann Law 26
  - Wien's displacement law 24
- blower-door test 541
- bolometer 137, 632, *see also* detectors, thermal detector
- Bouguer's law 572
- Brewster angle 14
- buildings 477
  - blower-door test 541
  - carport 529, 531
  - energy standards 488
  - external influences 486, 507
  - floor heating system 498
  - general rules 486
  - half-timbered houses 490
  - image representation 479
  - inside thermal insulation 497
  - moisture 509
  - optically induced thermal effects 539
  - quantitative analysis 549
  - radiative cooling 528
  - relevance of defects 494
  - shadows 518
  - solar load 519
  - solar reflections 520
  - structural defects 504
  - thermal bridges 500
  - TSR paints 552
  - view factor effects 525, 533
  - wind 507
  - windows 534

- c**
- calibration of IR camera 200
  - camera software 208
    - color palette 204, 208, 480
    - level 204, 208
    - level and span 480
    - span 204, 208
  - camera system performance 209
    - NETD 210
    - spatial resolution (IFOV, SRF) 213, 658
    - temperature accuracy 209
    - temperature resolution 210
    - time resolution 221
  - camera systems 173
    - comparison 186
  - carbon capture and storage (CCS) 594
  - cavity blackbodies 47, 437
  - chromatic aberrations 191
  - close-up lens 616
  - clouds 742
  - CO<sub>2</sub> imaging 594
  - condition monitoring 645
    - polymer molding 651
    - power plants 647
    - tank levels 649
  - conduction *see* heat transfer
  - convection *see* heat transfer
  - convection experiments 410
    - Bénard–Marangoni 412
    - water 412
  - Cooling, Newton's law 383, *see also* detectors
- d**
- D\* *see* detectors, performance parameters
  - detector noise
    - Johnson-Nyquist noise 113
    - short noise 119
    - temperature fluctuation noise 113
  - detectors 107
    - (HOT) detectors 132
    - bariode 136
    - cooling 123, 188
    - dual-band FPA 140
    - performance parameters 108
    - photon detectors 117, 125
    - temperature stabilization 117, 188
    - thermal detector 111
    - type II strained layer superlattice (T2SLS) detectors 137
  - dew point 372
  - diffuse reflections 272
  - diffusivity *see* thermal diffusivity
- e**
- digital detail enhancement (DDE) *see* image processing
  - dispersion 11
  - drone *see* remote sensing
  - dynamic range 204, 265, 266
- f**
- field of view (FOV) 108, 192
  - filters 229
  - focal-plane arrays (FPA) 114, 176
  - frame rate 175, 221
  - Fresnel equations 12
  - friction 394, 395
    - bicycle 396
    - cars 397, 403
    - motorcycle 397
    - weights 394
  - FTIR spectroscopy 258
  - furnace tubes 669

***g***

- gas sensors 635
- gases 443, 561
  - absorption 567, 597
  - broadband vs. narrowband 569
  - calibration curves 577
  - CO<sub>2</sub> 564, 571
  - compilation of spectra 564, 603
  - emission 567, 580, 597
  - exhaust gases 599
  - GasFind cameras 588
  - H<sub>2</sub>O 564
  - hydrocarbons 565
  - inorganic compounds 591
  - measurement conditions 578
  - measurements 588
  - molecular spectra 561
  - organic compounds (VOCs) 588
  - quantitative analysis 572
  - scattering 567, 597
  - SF<sub>6</sub> 593
  - spectrally resolved imaging 582
  - theory 561
- gasoline 592
- geometrical optics 10
  - laws of reflection and refraction 11
- geysers 754
- gray body 32

***h***

- heat capacity 374
- heat diffusion equation 375
- heat transfer
  - 1-dim. wall 364
  - analogy thermal/electrical circuits 365
  - conduction 352
  - convection 355, 507
  - radiation 356
  - relative contributions of radiation and convection 385
  - windows 369
- heating system 407, 498
- hidden structures
  - half-timbered houses 490
  - paint 740
- high speed imaging/recording 268, 618
- high voltage applications 656
  - fan defects 660
  - HV bushings 660
  - HV lines 659
  - substation transformers 657
- history of IR science 69
- history of IR technology 76

***hot springs***

- humidity air 372
- hyperspectral imaging *see* multi- and hyperspectral imaging

***i***

- IFOV *see* camera system performance
- image formation 173
  - bad pixel correction 186
  - fill factor 180
  - NUC 180
  - pixel number 178
- image processing 285
  - advanced methods 309
  - contrast and digital detail enhancement 300
  - deblurring of infrared images 321
  - feature extraction 316
  - geometrical transformations 313
  - high-sensitivity mode (HSM) 296
  - image building 289
  - image fusion 287
  - image subtraction 290, 543
  - noise reduction 311
  - pattern recognition 319
  - segmentation 314
  - spatial derivatives 296
  - time derivatives 293
- image quality 216
- inelastic collisions 398, 401
- integration time 221

**IR cameras**

- parameters 4
- signal contributions 142
- ir reflectography 461
- IR spectral regions 10

***k***

- Kirchhoff's law 32

***l***

- latent heats 357
- Leslie cube 36, 439
- line scanning 174, 694
  - principle 175
  - windshields 695
- lock-in thermography *see* active thermal imaging
- low voltage applications 653
  - electric boards 655
  - microelectronic boards 654
  - simple circuits 424

**m**

- measurement process 142
- measurements 443
- medical applications 709
  - acupuncture 716
  - breast thermography 718
  - pain management 712
  - pressure ulcers 720
  - Raynaud's phenomenon 719
  - standard conditions 710
- metal industry 662
  - Al strips 663
  - black emitter method 667
  - gold cup method 666
  - hot molds 662
- microscope objectives 616
- microsystems 615
  - cryogenic actuators 640
  - measurement requirements 616
  - micro heat exchangers 626
  - microelectromechanical systems (mems) 615
  - microreactors 619
  - miniaturized IR emitters 637
  - Peltier elements 639
  - thermal IR sensors 628
- microwave ovens 429
- mirages 752
- moisture detection 470
- moon 749
- MTF, MRTD and MDTD *see* image quality
- multi- and hyperspectral imaging 256
- music *see* arts

**n**

- narcissus effect 196
- nature *see* clouds, geysers, mirages, moon, sky, sun, volcanology
- NEP *see* detectors, performance parameters
- NETD 210, *see also* detectors, performance parameters; camera system performance
- Newton's law of cooling 383
- NonUniformity Correction (NUC) *see* image formation

**o**

- optical components IR camera 191
- optical materials properties 49
  - antireflection coatings 65
  - atmospheric transmission 53
  - thin film coatings 62
  - transmission spectra of materials 56
  - water 452

**p**

- paintings *see* arts
- Peltier element 188, 639
- petrochemical industry 588, 648
- photo diodes *see* detectors, photon detectors
- photoelectrical effect 117
- photon detectors *see* detectors
- phononconductors *see* detectors, photon detectors
- pixel number *see* image formation
- Planck's law 22
- polarization 271
  - Brewster angle 277
  - imaging polarimetry 284
  - thermal reflections 272
- predictive maintenance 645
- PtSi 128
- pulse thermography *see* active thermal imaging

**q**

- QWIP *see* detectors, photon detectors

**r**

- rack storage fire testing 652
- radiation transfer 20, 356
- radiative cooling *see* buildings
- radiometric chain 142
- radiometry 14
  - excitance 15
  - irradiance 15
  - Lambertian emitters 17
  - Lambertian radiators 35
  - radiance 17
  - radiant intensity 17
  - radiant power 15
  - radiation transfer 20
  - spectral radiometric quantities 15
  - view factor 20
- range of IR cameras 688
- ratio thermography 236, *see also* two color thermography

Rayleigh-Jeans approximation 240

reflection, specular and diffuse 12, 435

reflectography 740

remote sensing 695

- drone applications 699

- platforms 696

R-value *see* U-value

**s**

- selective emitters 32, 61
  - plastic experiments 684
  - plastic spectra 683

- Signal-Noise-Limited Detection 119  
 sky 742  
 software tools 208  
 solar cell inspections 343  
 solar constant 30, 76  
 solar power plants 699  
 solar spectrum 449  
 solid angle 16  
 Space shuttle 678  
 – reentry 681  
 – STS 135 682  
 specific heat 374  
 – heat capacity 374  
 spectral filters 66, 199, 230  
 specular reflections 272  
 sports 729  
 – american football 734  
 – squash 732  
 – tennis 398, 729  
 – volleyball 732  
 Stefan–Boltzmann Law 26  
 Stirling cooler 190  
 sun 749  
 superframing 265  
 surveillance and security 687  
 SW imaging 447  
 – application areas 451  
 – cameras 452  
 – commercial systems 473  
 – contrast enhancement 458  
 – differences to VIS, MW and LWIR 447  
 – high-temperature measurement 454  
 – liquids 452, 467  
 – plastics 460  
 – vegetation 456  
 switch-on behavior 205
- t**  
 teaching physics 393  
 – electromagnetism 424  
 – mechanics 394  
 – optics/radiation physics 432  
 – thermal physics 406  
 temperature accuracy 209
- temperature contrast 151  
 temperature resolution 210  
 temperature scales 6  
 thermal bridges 370, 500  
 thermal conductivity 353  
 thermal diffusivity 374  
 thermal mismatch 331, *see also* active thermal imaging, thermal waves  
 thermal penetration depth 332, *see also* active thermal imaging, thermal waves  
 thermal reflections 155, 272  
 – Fresnel equation 273  
 – identification and suppression 281  
 – measurements 280, 664  
 thermal shock behavior 206  
 thermal time constants 377, 382, 516  
 thermoelectricity 427  
 – Peltier effect 428, 630  
 – Seebeck effect 629  
 time resolution 221  
 transient effects  
 – modeling 379, 513  
 transient heating/cooling 373  
 – cheese cubes 418  
 two color thermography 236  
 – application 248  
 – comparison to single bond method 247
- u**  
 U-value 364, 495, 549
- v**  
 veterinary applications 721  
 – equine thermography 725  
 – zoo animals 723  
 view factor 20, 525  
 volcanology 756
- w**  
 Wavebands 146  
 Wien approximation 241  
 Wien's displacement law 24  
 wildfires 746  
 windows 534













