

- Abel's transformation, 795
- Absorbing medium, 50
- Absorptance, 21, 65–68
 - solar, 103, 821
 - spectral, directional, 65, 66
 - spectral, hemispherical, 66, 71
 - total, directional, 67, 68
 - total, hemispherical, 67
- Absorption, 2, 24, 304
 - gray, diffuse, 129
 - in a participating medium, 280–281
 - multiphoton, 612
 - negative, 304, 307
 - saturable, 612
- Absorption band, 58, 60, 84, 86
- Absorption coefficient, xxi, 24, 37, 85
 - band-integrated, xx
 - correlated, 345, 660
 - database, 669
 - effective, 307, 634, 635
 - for a particle cloud, 394, 395
 - for coal particles, 416
 - for Rayleigh scattering, 399
 - line-integrated, xix, 316
 - linear, 280, 307
 - mass, 280, 307
 - mean, 367–369
 - modified Planck-mean, 368
 - narrow band average, 327, 328
 - Planck-mean, 367, 395, 416, 417, 424, 635, 709
 - pressure, 280, 307
 - Rosseland-mean, 368, 395, 416, 417, 424, 635
 - scaled, 345, 660
 - spectral, 327
 - of carbon dioxide, 313, 324
 - of clear ice, 443
 - of clear water, 443
 - of halides, 441
 - of ionic crystals, 441
 - of lithium fluoride, 444
 - of nitrogen, 314
 - of silicon, 442
 - of window glass, 25, 442
 - true, 307
- Absorption cross-section, 389
- Absorption Distribution Function model, 654, 748
- Absorption edge, 441, 444
- Absorption efficiency factor, 389
 - for absorbing spheres, 393
 - for specularly reflecting spheres, 404
- Absorption suppression, 713
- Absorptive index, xviii, 7, 35, 36, 85, 86, 281, 290
- Absorptivity, xx, *see also* Absorptance
 - of a gas layer, 24
 - of a thick slab, 96
 - of an isothermal medium, 650
 - of carbon dioxide, 24
 - spectral
 - of a participating medium, 281, 644
 - total
 - of a gas, 363, 646
 - of a gas–particulate suspension, 646
 - of a participating medium, 644
 - of an isothermal medium, 647
- Acetylene, 430, 750, 751
- Acrylic paint, 94
- ADF method, 654, 679, 743, 748
- Aerogel, 729
- Aggregate
 - fractal, 414
 - soot, 414
- Air mass, 6
- Air plasma, 313
- Airy's formulae, 57
- Albedo, scattering, xxi, 26, 27, 285
- Alumina, 93, 112
- Aluminum, 76, 93, 112, 393, 809, 812
- Ammonia, 369
- Amorphous solid, 89, 442
- Amplitude function, 390, 398
 - for diffraction, 402
- Angle
 - azimuthal, xxi, 12
 - Brewster's, 48
 - critical, 48, 290
 - divergence, 427
 - of incidence, 45, 48, 71
 - of refraction, 45
 - opening, 104
 - phase, 33, 55, 448
 - polar, xxi, 12, 15
 - polarizing, 48
 - scattering, xxi, 391
 - solid, xxi, 11–13
 - zenith, 6
- Angle factor, *see* View factor, 131
- Angular frequency, xxi, 3
- Anomalous diffraction, 401–402
- Anomalous skin effect, 79, 82
- Apparent emittance, 172, 179, 213, 217
- Ash particle, 415
- Asymmetric top, 308
- Asymmetry factor, 391, 410, 412
 - for a particle cloud, 394, 396
 - for coal particles, 416
- Atomic force microscope, 815
- Attenuation
 - by absorption, 280–281

- by scattering, 281
- Attenuation vector, 33
- Azimuth, 38
- Azimuthal angle, xxi, 12
- Babinet's principle, 402
- Band
 - absorption, 84, 86
 - electron energy, 58
 - electronic–vibration–rotation, 313
 - fundamental, 311
 - molecular vibration, 442
 - overtone, 311
 - Reststrahlen, 84, 86, 88, 441, 442
 - symmetric, 350
 - vibration–rotation, 304, 308, 311
 - with a head, 312, 351
- Band absorptance, xvii, 333, 349, 351, 638, 647
 - for nonisothermal gas, 358
 - slab, 648
- Band absorptance correlation, 357
- Band approximation, 233, 234, 242, 761
- Band center, 311
- Band gap, 58, 441
- Band intensity, 349
- Band model
 - narrow band, 326–336
 - wide band, 349–362
- Band origin, 311, 312
- Band overlap, 362
- Band strength parameter, xx, 351, 355, 363
- Band width, 637
 - effective, xvii, 349
 - parameter, 351
- Band wing, 643
- bandapp, 234, 246, 857
- bandmxch, 234, 246, 857
- Bandpass filter, 84
- Basis function, 780
- Bayesian statistics, 796
- bbfn, 11, 855
- Beam channeling, 222
- Beam splitter, 110
- Beer's law, 24
- BFGS scheme, 789
- Bidirectional reflection function, 198, 235, 238
 - for magnesium oxide, 70, 91
 - spectral, 68, 90
 - total, 71
- Black chrome, 103
- Black nickel, 103
- Black surface, 5
- Black-walled enclosure, 5, 160, 161
- Blackbody
 - manufacture of, 179
 - reference, 449
- Blackbody cavity, 172
- Blackbody cavity source, 107
- Blackbody emissive power, xvii, 7, 15, 833–835
 - fraction of, xviii, 10, 833–835
 - total, 10
- Blackbody intensity, xviii, 14, 15, 305
- Bleaching, 612
- Boltzmann number, xvii, 741
- Boltzmann's constant, xviii, 7
- Boltzmann's distribution law, 305
- Boltzmann, Ludwig Erhard, 10
- Bound electron transition, 76
- Boundary layer, 738–743
- Box model, 349, 637–643
- Brass, oxidized, 197, 198
- Bremsstrahlung, 304
- Brewster's angle, 48, 448, 807
- Brewster, Sir David, 48
- Broadening
 - collision, 316
 - Doppler, 316–318
 - line, 24, 304, 316
 - Lorentz, 316
 - natural line, 316
 - Stark, 316, 317
 - Voigt, 319
- Bundle, energy, 249
- Calcium carbonate, 763
- callemdiel, 856
- callemmet, 856
- Candela, 18
- Carbon
 - foam, 450
 - particle, 760
- Carbon capture, 751
- Carbon dioxide, 312, 315, 323, 351, 353–355, 360, 364, 365, 374, 651, 652, 654, 655, 662, 669, 671
 - Planck-mean absorption coefficient, 368
 - total emissivity, 365, 366
- Carbon foam, 445
- Carbon monoxide, 351, 353, 354, 356, 363, 369
- Carbon particle, 418, 763
- Case's normal-mode expansion technique, 475
- Causal relationship, 448
- Cavity
 - conical, 213
 - cylindrical, 171, 179, 213
 - hemispherical, 184
 - spherical, 213
- CDS database, 323, 341, 669, 670, 678, 684
- Cell
 - cold-window, 370
 - hot-window, 370
 - nozzle seal, 371, 372
- Cement, 763
- Central limit theorem, 251
- Ceramics
 - reticulated porous, 446, 447, 450, 760, 761
- Cerium dioxide, 762
- Cesium, 77
- Chamotte, 760
- Char, 415
- Charge density, xxi, 32
- Chemical reaction, 752, 754
- CHEMKIN, 750
- Chopper, 111, 370
- Chrome-oxide coating, 103
- Chromium, 815
- CLAM scheme, 559
- Cluster T-matrix method, 414
- Coal gasification, 763

- Coal particle properties, 415–418
- coalash, 858
- Coating, 53, 98–99
 - antireflective, 53
 - chrome-oxide, 103
 - for glass, 103
 - nickel-oxide, 103
 - reflectivity, 98
 - surface, 95
- Cobalt, 77
- Coherence, 803
- Coherence length, 803
- Coherence time, 803
- Cold medium approximation, 287
- Collimated irradiation, 66, 216, 222, 545, 610–625
- Collision broadening, 316
- Collisional interference, 316
- Color center, 441
- Colors of the sky, 399
- Combustion, 748–751
- Complex index of refraction, xix, 35, 73, 74, 388
 - of ash, 415
 - of coal, 415
 - of metals, 77
 - of semiconductors, 77
 - of various soots, 421
- Composition PDF method, 756
- Composition variable, 754, 756
- Computational fluid dynamics, 751
- Computer codes, 855–862
- Computing, parallel, 261
- Concentrator, compound parabolic, 760
- Condition number, 783, 785
- Conduction, 1, 2, 460, 706
- Conduction-to-radiation parameter, xix, 270, 725, 741, 745
- Conductivity
 - dc-, 76, 79
 - electrical, xxi, 32, 36, 57, 76, 77, 79
 - radiative, 483
 - thermal, xviii, 2
- Configuration factor, *see* View factor, 131
- Conjugate gradient method, 792–796
- Conjugation coefficient, 793
- Conservation of energy, 2
 - overall, 297–298
 - radiative, 295, 458
- Contour integration, 134
- Convection, 1, 2, 460, 706
 - free, 743
 - in boundary layers, 738–743
 - in internal flow, 744–753
 - interfacing with radiation, 751
- Convection-to-radiation parameter, xvii, 741
- Copper, 76, 77, 93, 814
- Correlated k -distribution, 326
 - global, 326, 661
 - narrow band, 345
 - wide band, 326, 359–362
- Correlation length, xxi, 91
- Cosine law, 15
- Couette flow, 746
- Critical angle, 48, 290, 804, 806
- Cross-section
 - for absorption, 389
 - for extinction, 389
 - for scattering, 389
- Crossed-strings method, 135, 147, 162
- Crossover wavelength, 82
- Crystal lattice, 57, 83
- Cumulative k -distribution, 337, 360, 658, 663
- Cumulative wavenumber, 665
- Current density, 810
- Curtis–Godson approximation, 334
- Cutoff wavelength, 102
- Cylinders, concentric
 - at radiative equilibrium, 474, 484, 490, 508
 - discrete ordinates method, 554–555
 - without participating medium, 176, 201, 205, 589
- Cylindrical fiber
 - absorption and scattering by, 408
- Cylindrical medium, 471–474
 - discrete ordinates method, 554–555
- Damping parameter, 792
- Darkening, 612
- Database
 - absorption coefficient, 669
 - CSD, 323, 341, 669, 670, 678, 684
 - EM2C, 333, 341, 374, 652, 655, 671, 672
 - HITEMP, 323, 341, 347, 362, 368, 627, 652, 655, 657, 662, 663, 667–672, 676, 678, 684, 861
 - HITRAN, 312, 315, 323, 330, 333, 334, 341, 368, 374, 627, 655, 669, 671, 861
 - k -distribution, 671
 - NBKDIR, 341
 - NEQAIR, 323
 - NIST, 325
 - RADCAL, 333
 - SPECAIR, 323
 - SPRADIAN, 323
- Dc-conductivity, 76, 79
- Degeneracy, xviii, 305, 308, 352
- Degrees of freedom, of a molecule, 308
- Deissler’s jump boundary conditions, 484
- Delta–Eddington approximation, 411
- Density, xxi
 - charge, xxi, 32
 - optical, 48
 - partial, of absorbing gas, 320
- Density path length, 320
- Detectivity, xvii, 110
- Detector, 108–110, 450
 - fiber-optic, 428
 - photon or quantum, 109
 - pyroelectric, 370
 - thermal, 109
- Diamond differencing, 557
- Diamond scheme, 559
- Dielectric film, 56
- Dielectric function, xx, 57–59, 74, 75, 810
- Dielectric layer, 93
- Dielectric medium, 36, 45, 55, 74
- Differential approximation, *see* P_1 -approximation, 488, 497, 502–509, 730
 - modified, 527–531
- Diffraction, 25
 - by a particle, 387
 - from large spheres, 402

- Diffraction peak, 397
 Diffraction theory, 90
 Diffuse emission, 15, 129
 Diffuse emitter, 62
 Diffuse irradiation, 71
 Diffuse reflectance, 69
 Diffuse reflector, 70
 Diffuse view factor, *see* View factor, 131
 Diffusion approximation, 299, 482–486, 741, 761–763
 Diffusion flame
 laminar, 750, 751
 Dipole, 809
 Dipole element, 314
 Dipole moment, 309, 443
 Dirac-delta function, xx, 337, 409, 411, 610
 Direct numerical simulation, 751, 759
 Direction
 of incidence, 71
 of propagation, 281
 specular, 69, 236, 289
 Direction cosine, xviii, xxi, 135, 457, 490
 Direction vector, xix, 11, 36, 135, 456, 697
dirreflec, 856
 Discrete dipole approximation, 414, 422
 Discrete ordinate method, 761
 Discrete ordinates method, 299, 300, 488, 532, 541–584
 even-parity, 573
 modified, 572–573
 Discrete transfer method, 300, 564, 572, 575
 Dispersion, 57, 420
 anomalous, 59
 normal, 59
 Dispersion exponent, 419
 Dispersion relation, 807, 809
 Dispersion theory, 73–75
 Dissipation function, xxi, 297
 Distribution function
 cumulative, 249
 Gaussian, 398
 particle, xix, 395, 416, 417
 Divergence angle, 427
 Dopant, 441
 Doppler broadening, 316–318
 Doppler effect, 318, 426
 Doppler shift, 318
 Drude theory, 75–78, 809, 812
 Dyadic Green's function, xviii, 810, 811

 Eddington approximation, 299
 Eddy dissipation model, 753
 Efficacy, luminous, 18, 19
 Efficiency factor, 389
 absorption, 389
 for absorbing spheres, 393
 for specularly reflecting spheres, 404
 extinction, 389
 for dielectric spheres, 392
 for long cylinders, 409
 for water droplets, 398
 Rayleigh scattering, 398
 scattering, 389
 for absorbing spheres, 393
 for long cylinders, 409
 for specularly reflecting spheres, 404

 Efficiency, luminous, 18, 19
 Eigenfrequency, 310
 Einstein coefficients, xvii, 305–308, 313
 Electric field, xvii, 32
 Electrical conductivity, xxi, 32, 36, 57, 76, 77, 79
 Electrical conductor, 36, 58, 60, 75
 Electrical network analogy, 173–177, 214, 215
 Electrical permittivity, xx, 32, 57, 808, 810
 Electrical resistivity, 76
 Electromagnetic energy, 36
 Electromagnetic wave, 1, 3, 32
 Electromagnetic wave spectrum, 3, 4
 Electromagnetic wave theory, 3, 31–60, 73–75
 Electron, 809
 bound, 58, 60
 free, 32, 58, 60, 75, 442
 Electron energy, 58, 59
 Electron volt, 4
 Electronic transition, 86, 442
 Electronic–vibration–rotation
 band, 313
 Electrostatic approximation, 423
 Ellipsometric parameter, 38, 40
 Ellipsometric technique, 448, 449
 Ellipticity, 38
 Elsasser model, 327–329
 EM2C database, 333, 341, 374, 652, 655, 671, 672, 860
emdiel, 88, 856
emdielr, 88
 Emission, 1
 blackbody, 7
 diffuse, 15, 62, 63, 129
 from a gas volume, 362
 from a volume element, 282
 from any isothermal volume, 293
 gray, diffuse, 129
 luminous, 415
 spontaneous, 304, 305, 307
 stimulated, 304, 305, 307, 315
 Emission coefficient, 282, 307
 Emission measurement, 111–113
 Emissive power, xvii, 5–11
 apparent, 217
 blackbody, xvii, 7, 15, 833–835
 blackbody spectrum, 8, 9
 directional, 15
 effective, 166
 maximum, 8
 spectral, 5, 62
 spectral, directional, 62
 total, 5, 10
 weighted, 604
 Emissivity, xx, *see also* Emittance
 narrow band, 327
 of a nonhomogeneous layer, 345
 of an isothermal medium, 282, 650
 spectral, 327
 of a participating medium, 644
 of an isothermal layer, 282, 629
 spectral, directional
 of nonconductors, 87
 spectral, hemispherical, 80
 of nickel, 80
 of nonconductors, 87

- spectrally averaged, 328
- total
 - of a gas, 362–367
 - of an isothermal layer, 633
 - of carbon dioxide, 365, 366
 - of water vapor, 364, 366
- total, directional, 81
- Emittance, 22, 62–64
 - apparent, 172, 179, 213, 217
 - hemispherical, 22
 - infrared, 103
 - of selected materials, 22
 - spectral, directional, 62, 68
 - spectral, hemispherical, 62
 - of tungsten, 83
 - spectral, normal
 - of aluminum, 93, 94
 - of zirconium carbide, 90
 - total, directional, 62, 64, 68
 - of several metals, 63
 - of several nonmetals, 63
 - total, hemispherical, 64, 68
 - of a metal, 82
 - total, normal, 78, 79
 - of polished metals, 79
 - tables, 821
- Emitted energy, 13
- emmet, 80, 856
- emwbm, 858
- Enclosure, 130
 - black-walled, 5, 160, 161, 531, 532, 643
 - closed, 130, 164
 - idealized, 129, 130, 160, 203, 214
 - isothermal, 203
 - long, 147
 - open, 164, 206
- Energy
 - electromagnetic, 36
 - internal, xx, 23, 297, 304
 - of a photon, 3
 - solar, 2
- Energy bundle, 249
 - path, 253
- Energy conservation equation, 297
- Energy density, radiation, 292
- Energy level
 - electronic, 23
 - molecular, 303, 310
 - rotational, 23, 304, 308
 - vibrational, 23, 83, 304, 308, 310, 312
- Energy partitioning, 262, 713
- Enthalpy, 752, 754
- Environment, large, isothermal, 170
- Epoxy coating, 94, 103
- Equation of transfer, *see* Radiative transfer equation (RTE)
- Equilibrium radiation, 305
- Error, statistical, 248
- Ethene, 430
- Ethylene, 750, 758
- Euler angles, xx, 512, 513
- Euler's constant, xx, 333, 853
- Evanescence wave, 804–806
- Even-parity formulation, 573
- Exchange area
 - direct, xviii, xix, 585–586, 590–592, 596–597
 - determination of, 606
 - total, xviii, xix, 586–590, 593–596, 598–600
- Exchange factor, xviii, 252, 254, 585, 586, 695
- Exchange function, 812
- Exponential integral, xvii, 333, 459, 852–854
- Exponential kernel approximation, *see* Kernel approximation
- Exponential scheme, 559
- Extinction, 281, 389
- Extinction coefficient, xx, 25, 281, 426
 - for a particle cloud, 394, 395
 - for coal particles, 415, 416
 - modified, 558
 - Planck-mean, 395, 416, 417, 424
 - Rosseland-mean, 395, 416, 417, 424, 446, 483, 634
- Extinction efficiency factor, 389
 - for dielectric spheres, 392
 - for long cylinders, 409
 - for water droplets, 398
- Extinction paradox, 402
- False scattering, 560
- Favre averaging, 753
- FDF method, 759
- Fiberglass, 450
- Fibers, scattering by, 409, 450
- Fictitious gas technique, 348, 654, 679
- Figure of merit, 712
- Film
 - dielectric, 56
 - metallic, 176
 - nonmetallic, 103
 - porous, 99
 - slightly absorbing, 56
 - thick, 56
 - thin, 53, 447
- Filter, bandpass, 84
- Filter, optical, 107
- Filtered density function, 759
- Fin efficiency, 270
- Fin radiator, 268
- Finite volume method, 300, 566–572
- Flame
 - axisymmetric, 533
 - laminar diffusion, 749
 - luminous, 758, 759
 - nonluminous, 758
- Flame D, Sandia, 533, 668, 757, 758
- Fluctuation–dissipation theorem, 810
- Fluctuational electrodynamics, 803, 809
- Fluidized bed, 408
- Fluidized bed, solar, 760
- Flux
 - heat, xix, 2
 - luminous, xix, 19
 - momentum, 17
- Flux method, 574
- Fly ash properties, 415–418
- F_N -method, 475
- Foam
 - closed cell, 446
 - open cell, 444
- Foam insulation, 450

- Forced collisions, 713
 Fourier's law, 2, 28, 297
 Fractal aggregate, 414, 422
 Fractal prefactor, xviii, 422, 424
 Fractal surface, 91
 Fredholm integral equation, 178, 179, 462
 Free electron, 32, 75, 442
 Freezing, 733–738
 Frequency, xxi, 3
 - angular, xxi, 3
 - of radiation, 2
 - plasma, 59, 76
 - resonance, 59
- fresnel, 47, 52, 87, 856
 Fresnel's relation, 47, 52, 73, 74, 79, 85, 86, 290
 Fresnel, Augustin-Jean, 47
 FSCK method, 534, 662, 684, 704
 FSCK Monte Carlo, 704
 FSK method, 656–686
 fskdco2, 670, 672, 678
 fskdco2, 859
 fskdco2dw, 670
 fskdco2dw, 859
 fskdh2o, 670, 678
 fskdh2o, 859
 fskdh2odw, 670
 fskdh2odw, 859
 fskdist, 669, 672, 859
 fskdistmix, 859
 FSSK method, 664, 684
 FTIR spectrometer, 108, 370
 ftwbm, 357, 858
 Fuel sprays, 706
 Full spectrum k -distribution, 656–686
 Function estimation, 779
 Fundamental band, 311
 Furnace, 449
 - high-temperature, 371
 - sealed-chamber, 449
- FVM2D, 861
 FwdMCcs, 719
 FwdMCxx, 860
- Galerkin method, 475
 Gamma distribution, 395
 Gamma rays, 94
 Gas
 - emission from, 362
 - mixture, 334, 341, 673
 - sum of gray gases, 603, 649–654
 - total absorptivity, 363
 - total emissivity, 362
- Gas layer
 - isothermal, 282, 321
 - nonisothermal, 334
- Gas–particulate mixture, 635, 646
 Gauss' theorem, 43
 Gauss-Newton method, 782
 Gaussian distribution function, 398
 Genetic algorithms, 796
 Geometric optics, 26, 53, 92, 95, 389, 402
 Geometric path length, 320
 Glass, 86
 - multiple panes, 99
 - single pane, 95
 - soda–lime, 97
- Global model, 326, 655
 Global warming, 2, 303, 651
 Globar light source, 107, 427
 Godson approximation, 329
 Gold, 77
 Goody model, 330, 701
 Graphite
 - pyrolytic, 653
- Gray medium, 295, 299
 Gray source, 68
 Gray surface, 64
 Gray, diffuse surface, 64, 160, 165, 288
 graydiff, 172, 857
 graydiffch, 172, 194, 195, 857
 graydifspecc, 204, 228, 857
 Greenhouse effect, 2, 96
 Grid system, 751
 Groove
 - right-angled, 164, 170
 - V-corrugated, 104, 105, 211, 212, 222, 236
- grspeccch, 204, 228, 857
- Hagen–Rubens relation, 77, 78
 Half-width, line, 316, 318
 Halide, 444
 Harmonic oscillator, 58, 74, 310, 311, 314
 Heat conduction, 297
 Heat flux, xix, 2
 - at a surface, 202
 - average, 162
 - directional, 15
 - outgoing, 202
 - prescribed, 272
 - radiative, 13, 15–17, 66, 292–293
 - reflected, 69
- Heat flux vector, 297
 Heat of fusion, 735
 Heat rate, xix, 2
 Heat rejector, radiative, 101, 103
 Heat source, 297, 298
 Heat transfer coefficient, xviii, 2, 815
 - convective, 174, 271
 - radiative, 270
- Heaviside's unit step function, xviii, 338, 620, 637, 665, 718
 Helmholtz equation, 504, 810
 Hemisphere, 11
 Hemispherical cavity, 184
 Hemispherical volume, 629
 Henyey–Greenstein phase function, 410, 411
 Hessian matrix, 788, 789
 HITEMP database, 323, 341, 347, 362, 368, 627, 652, 655, 657, 662, 663, 667–672, 676, 678, 684, 861
 HITRAN database, 312, 315, 323, 330, 333, 334, 341, 368, 374, 627, 655, 669, 671, 861
 Hohlraum, 107, 112
 Hole, cylindrical, 171, 179
 Hot band, 315
 Hot line, 315, 323, 348, 368
 Hottel, Hoyte Clark, 147

- Ice, 443
- Ill-conditioned problem, 782
- Ill-posed problem, 779, 780
- Illumination, 19, 217
- Image, 199, 207
- In-scattering, 27, 282
- Incidence angle, 45, 71
- Incidence direction, 71
- Incident radiation, xviii, 287, 292
 - for a plane-parallel medium, 458
- Index of refraction, complex, *see* Complex index of refraction
- Induced emission, *see* Emission, stimulated 304
- Infrared emittance, 103
- Infrared radiation, 4, 304, 441
- Inside sphere method, 135
- Insulation, foam, 450
- Insulator, 58
- Integral equation
 - for outgoing intensity, 235
 - for radiosity, 166, 203
 - for specular reflections, 220
 - Fredholm, 178, 179
- Integrating sphere, 426, 430
- Intensity, xviii, 13–15
 - blackbody, xviii, 14, 15, 305
 - in vacuum, 20–21, 234
 - outgoing, 235
 - reflected, 69, 235
 - weighted, 651
- Interaction
 - radiation and combustion, 748–751
 - radiation and conduction, 268–271, 724–733
 - radiation and convection, 271–275, 738–748
 - radiation and melting/freezing, 733–738
 - radiation and turbulence, 753–759
- Interface
 - moving, 736
 - optically smooth, 45, 73
 - plane, 43, 44
- Interface condition, 43, 44, 50, 736
- Interface reflectivity, 48, 49, 51, 52
- Interfacing, convection with radiation, 751
- Interference structure, 398
- Interference, wave, 53, 56, 98, 99
- Internal energy, xx, 23, 297, 304
- Invariance, principle of, 475
- Inverse Bremsstrahlung, 304
- Inverse heat transfer, 779
- Inverse radiation, 779–796
- Ionic crystal, 440, 441
- Iron, 77
- Irradiation, xviii, 130, 160, 166, 532
 - collimated, 66, 216, 222, 545, 610–625
 - diffuse, 66, 71
 - diffuse and gray, 67
 - directional, 65
 - external, 161, 162, 202
 - gray, 67
 - laser, 229, 610, 611
 - polarized, 86, 197
 - solar, 6, 611
 - spectral, directional, 65
 - spectral, hemispherical, 70
 - total, 67
- Isotropic medium, 32
- Isotropic scattering, 283, 287, 299, 391, 411
- Isotropic surface, 63
- Jacobian, 781
- Jeans, Sir James Hopwood, 6
- Jet diffusion flame
 - nonluminous, 756
- Jet engine, 752
- Jet flame, 533
- Jump boundary condition, 485
- k*-distribution, xviii, 326, 359–362, 748
 - cumulative, xviii, 337, 360, 658, 663
 - databases, 671
 - for mixtures, 673
 - global, 326, 656–686
 - narrow band, 336–349
 - Planck function weighted, 656, 661
 - wide band, 326
- Kalman filtering, 796
- kdistmix, 859
- Kernel, 178, 491
- Kernel approximation, 179, 182, 300, 491–493
- Kirchhoff approximation, 92
- Kirchhoff's law, 5, 14, 74, 236
 - for absorptance, 66
 - for bidirectional reflection, 69
- Kirchhoff, Gustav Robert, 5
- Kramers–Kronig relation, 448
- Kronecker's delta, xx, 164, 204, 781
- Ladenburg–Reiche function, 321
- Lambert, 18, 62
- Lambert's law, 15, 62
- Lambert, Johann Heinrich, 15
- Laplace transform, xix
- Laplace's equation, 504
- Large eddy simulation, 751, 759
- Laser, 729
 - pulsed, 610, 619–622
- Laser irradiation, 229, 610, 611
- Laser light source, 106
- Latex particles, 427, 430
- Lattice defect, 79, 82, 83, 85, 103, 441
- Lattice vibration, 58, 88, 809
- Lattice, crystal, 57, 83
- Law of reciprocity
 - for bidirectional reflection function, 69
 - for diagonally opposed pairs, 145
 - for direct exchange areas, 586, 592
 - for exchange factors, 253
 - for specular view factors, 200
 - for total exchange areas, 587, 593
 - for view factors, 131–133
- Layer
 - dielectric, 93
 - of alumina, 93
 - of silica, 94
 - opaque, 85
 - oxide, 93, 94
 - surface, 79, 84, 93
 - thick dielectric, 98

- thin, 93
- LBL, *see* Line-by-line calculations
- Least squares norm, 780
- Leckner, 366, 858
- Legendre polynomials, xix, 391, 456
 - associated, 456, 496, 502
 - orthogonality of, 498
 - polyadic, 497
- Leibniz's rule, 103, 183
- Lens, 110
- Levenberg–Marquardt method, 792, 796
- Light, 3, 18
 - polarized, 448
- Light guide, 223
- Light line, 809
- Light source, 106, 370
 - blackbody cavity, 107
 - globar, 107, 427
 - laser, 106
 - Nernst glower, 107
- Lighting, 18, 218
- Lime, 763
- Line
 - absorption–emission, 23
 - collision-broadened, 316
 - Doppler-broadened, 316
 - hot, 348
 - isolated, 316
 - Lorentz, 316
 - no overlap, 329
 - rotational, 304
 - spectral, 304, 308, 315
 - strong, 329, 330
 - Voigt-broadened, 316
 - weak, 329, 330
- Line broadening, 24, 304, 316
- Line half-width, xx, 316, 318
- Line intensity, 306, 313
- Line mixing, 316
- Line overlap parameter, xx, 328, 355, 356
- Line shape, 316
- Line shape function, xxi, 306, 316
- Line spacing, xvii, 327, 328
- Line strength, xix, 306, 316, 317
- Line strength parameter, xx, 313, 314, 321, 328
- Line structure effects, 702
- Line width, equivalent, xx, 320, 329, 330
 - nonhomogeneous path, 335
- Line-by-line calculations, 325, 627, 652–654, 659, 667, 668, 673, 678, 702
- Line-by-line Monte Carlo, 702
- Linear-anisotropic phase function, 411
- Linear-anisotropic scattering, 299, 411
- Liquid
 - high-temperature, 449
 - semitransparent, 442
- Lithium, 77
- Lithium fluoride, 444
- Lorentz broadening, 316
- Lorentz model, 75, 440, 441, 813
 - single oscillator, 83, 813
- Lorentz, Hendrik Anton, 58
- Lorenz, Ludvig, 388
- Lorenz–Mie scattering, *see* Mie scattering
- Lumen, 18, 217
- Luminance, xviii, 18–19
- Luminous efficacy, xviii, 18, 19
- Luminous efficiency, xxi, 18, 19
- Luminous emission, 415
- Luminous flame, 758, 759
- Luminous flux, xix, 19
- Lux, 18
- Magnesium oxide, 84, 88, 90, 91, 116
 - bidirectional reflection function, 69, 70
- Magnetic field, xviii, 32
- Magnetic permeability, xxi, 32, 37, 47, 808
- Malkmus model, 330, 332, 339, 655
- Manganese sulfide, 55
- Mark's boundary condition, 499
- Marshak's boundary condition, 500, 512–519, 522, 529
- Mass fractal dimension, xvii, 422, 424
- Mass fraction, xx
- Maxwell's equations, 32, 389
- Maxwell, James Clerk, 32
- MCintegral, 858
- Mean beam length, xviii, 628–633, 639
 - definition, 628–630
 - for an isothermal gas layer, 629
 - for optically thin media, 630–631
 - geometric, 630
 - spectrally averaged, 631–633
- Mean free path
 - for a photon, 2, 281
 - for absorption, 281
 - for collision, 2
 - for scattering, 281
- Mean square deviation of the mean, 251
- Measurement
 - absolute, 427
 - emission, 111–113
 - gas properties, 369–374
 - multiple-scattering, 428
 - reflection, 113–118
 - relative, 427
 - scattering, 427
 - semitransparent media, 447–450
 - transmission, 369
- Medium
 - absorbing, 50
 - cold, 287
 - conducting, 73
 - cylindrical, *see* Cylindrical medium
 - dielectric, 45, 55, 74
 - gray, 295, 299
 - isotropic, 32
 - nonabsorbing, 38
 - nongray, 299, 603–606, 626–686
 - nonhomogeneous, 334, 345
 - nonmagnetic, 36, 37, 57
 - nonparticipating, 20, 129
 - nonscattering, 286
 - opaque, 61, 74
 - optically thick, 462
 - participating, 21, 279
 - plane-parallel, *see* Plane-parallel medium
 - scattering, 287
 - semitransparent, 85, 95, 280, 440–450, 733–738

- spherical, *see* Spherical medium
- transparent, 462
- Melting, 733–738
- Mesh, numerical, 752
- Metaheuristics, 785, 794–796
- Metallic foam, 445
- Methane, 323, 351, 353, 354, 356, 369, 533, 749, 750, 760, 762
- Microgravity, 750
- Mie scattering, 26, 389, 467
 - equivalent-sphere, 423
- Mie scattering coefficient, 391
- Mie theory, 762
- Mie, Gustav, 388
- Milne–Eddington approximation, 488–491
- Minimization, 792
- Mirror, 14, 69, 110, 117, 197
 - platinum, 449, 450
 - spherical, 449, 450
- Mixture
 - gas, 334, 673
 - gas–particulate, 635, 646
- mmmie, 393, 396, 859
- mocacyl, 860
- Modified differential approximation, 527–531
- Mole fraction, xx
- Moment method, 299, 488–491, 495
- Momentum, of photons, 17
- Monochromatic radiation, 6
- Monochromator, 108, 370, 450
- MONT3D, 254, 860
- Monte Carlo method, 134, 247–266, 300, 532, 694–723, 761, 762
 - results for a V-groove, 222, 236
 - results for a gas slab, 637
- MSFSK method, 679, 684, 686
- Mueller matrix, 42
- Mullite, 446, 450
- Multigrid algorithm, 752
- Multiphoton absorption, 612
- Multisphere Mie solution, generalized, 414
- Mushy zone, 734, 735

- Nanoscale radiation, 803–815
- Narrow band model, 325–336, 700
- Narrow band model Monte Carlo, 700
- Narrow band parameter, 327
- Natural line broadening, 316
- NBKDIR database, 341, 670, 671, 678, 684, 861
- nbkdistb, 339, 858
- nbkdistsg, 339, 858
- Negative index materials, 808
- Nephelometer, 427, 430
- NEQAIR database, 323
- Nernst glower, 107
- Net radiation method, 166, 238–242, 763
- Neural networks, 796
- Neutron transport theory, 495, 541
- Newton’s direction, 789
- Newton’s method, 789
- Nickel, 77
- Nickel-oxide coating, 103
- NIST database, 325
- Nitric oxide, 353, 369
- Nitrous oxide, 351, 369
- Nonconductor, of electricity, 58
- Nonequilibrium radiation, 306, 321
- Nonequilibrium radiation, 285
- Nongray medium, 299, 603–606, 626–686
- Nongray surface, 230
- Nonluminous flame, 758
- Number density, 396
 - molecular, 307, 317
- Numerical quadrature, 179, 181, 542
- Nusselt number, xix, 745

- Objective function, xviii, 780, 781, 784, 790, 793
- Obstruction, visual, 147, 208
- Off-specular peak, 91
- Opacity Project, 325
- Opaque, 4
- Opaque medium, 61, 74
- Opaque surface, 5, 11, 21–22, 61
- Opening angle, 104
- Optical constants, 57–60
- Optical coordinate, xxi, 285
- Optical density, 48
- Optical depth, 455
- Optical filter, 107
- Optical path length, xx, 320
- Optical thickness, xxi, 455
 - for absorption, 281
 - for extinction, 281
 - for scattering, 281
 - narrow band, 328
 - of a spectral line, 321
- Optically thick approximation, 482–486
- Optically thin approximation, 299, 480–481
- Optics
 - collection, 450
 - geometric, 26, 53, 95, 389, 402
 - thin film, 53
- Optimization, 795
 - gradient-based, 785, 788–794
- Oscillator
 - double, 84
 - harmonic, 58, 74, 310, 311, 314
 - isolated, 75
 - single, 83, 813
- OTFA, 755, 756
- Out-scattering, 27, 281
- Overlap
 - band, 362
 - line, 327
- Overlap parameter, xxi, 636
 - (for MSFSK), 681
- Overtone band, 311
- Oxide film, 93–94
- Oxy-fuel, 651, 750

- P1–2D, 859
- P₁-approximation, 497, 502–509, 761
 - for box model, 642–643
 - semigray, 634
 - transient, 620
 - with collimated irradiation, 616–618
 - with conduction, 730
- P_{1/3}-approximation, 620

- P1sor, 505, 859
 P_3 -approximation, 497, 509
 Packed bed, 763
 Palladium, 77
 Parallel computing, 261
 Parallel plates, 173, 176, 179, 200, 204, 220, 811–812, 815
 Parameter vector, xix, 780, 781, 793, 796
 parlplates, 146, 159
 parlplates.cpp, 856
 parlplates.m, 856
 Particle
 ash, 415
 carbon, 760
 coal, 415
 large, 402
 model, 707
 soot, 398
 spherical, 387
 stochastic, 706
 Particle beds, 408
 Particle distribution function, 395, 416, 417
 Particle size parameter, *see* Size parameter
 Particle suspension, 427, 428, 646, 706, 746
 Partition function, 314
 Path length
 density, 320
 geometric, xix, 320
 optical, xx, 320
 pressure, 320
 Pathlength method, 713
 PDF method, 706, 754, 756, 758
 Peak
 backward-scattering, 397, 407, 410, 412
 diffraction, 397
 forward-scattering, 393, 397, 401
 off-specular, 91
 specular, 69
 Pellet-reflection technique, 420, 421
 Pencil of rays, 15, 16
 Permeability, magnetic, xxi, 32, 37, 47, 808
 Permittivity
 complex, xx, 33, 43
 electrical, xx, 32, 57, 808, 810
 relative, 57
 perpplates, 146, 159
 perpplates.cpp, 856
 perpplates.m, 856
 Phase angle, 33, 55, 448
 of polarization, xx, 40
 Phase function, xxi, 25, 283, 390, 391
 approximate, 410–413
 for a particle cloud, 394, 396
 for absorbing particles, 396
 for dielectric particles, 397
 for diffraction, 402
 for diffusely reflecting spheres, 407
 for large spheres, 405
 for Rayleigh scattering, 399, 400
 for Rayleigh–Gans scattering, 401
 for single sphere, 394
 for specularly reflecting spheres, 404
 Henry–Greenstein, 410, 411
 isotropic, 411
 linear-anisotropic, 411
 Phase velocity, 34, 36, 401
 Phenomenological coefficient, 32, 36, 57
 Phonon, 58, 807, 809
 Photoacoustic, 426
 Photolysis, 612
 Photometer, scattering, 426
 Photon, 1–3
 Photon detector, 109
 Photon energy, 4
 Photon gas, 503
 Photon momentum, 17
 Photon pressure, 17
 Photon–phonon interaction, 83
 Photovoltaics, 759
 planck, 11, 855
 Planck function, xviii, 15
 Planck number, 270
 Planck oscillator, xxi, 810
 Planck’s constant, xviii, 3
 modified, 309
 Planck’s law, 7, 9, 306
 Planck, Max, 7
 Planck-mean absorption coefficient, 367–369, 635, 705, 709
 for coal particles, 416, 417
 for particles, 395
 for soot, 424
 modified, 368
 Planck-mean extinction coefficient
 for coal particles, 416, 417
 for particles, 395
 for soot, 424
 Planck-mean temperature, 666
 Plane
 of equal amplitude, 34, 44
 of equal phase, 33, 44
 of incidence, 45, 91
 Plane wave, 33, 38, 44
 Plane-parallel medium
 approximate methods, 480–494
 at radiative equilibrium, 461–467, 639–643
 discrete ordinates method, 545–550
 exact formulation, 454–458
 isothermal, nongray gas, 633, 648–649
 isothermal, nonscattering, 522, 595
 nonscattering, 459–465
 optically thick, 482–486
 optically thin, 480–481
 scattering, 465–467
 specified temperature field, 460–461, 463–466
 Plasma, 317
 Plasma frequency, 59, 76
 Platinum, 77, 79, 80, 230
 P_N -approximation, 495–534
 Simplified, 495, 522–526
 Point collocation method, 475
 Poiseuille flow, 744
 Polar angle, xxi, 12, 15
 Polaritons, 807
 Polarization, 37–42, 612
 circular, 38, 41
 degree of, 41
 elliptical, 38

- linear, 38, 41
- parallel, 40, 73, 101
- perpendicular, 40, 73, 101
- plane, 38
 - state of, 38, 197
- Polarization ellipse, xvii, xx, 38
- Polarization phase angle, xx, 40
- Polarized light, 448
- Polarizer, 427
- Polarizing angle, 48
- Pollutants, 750
- Polystyrene, 446
- Porous film, 99
- Position vector, 135, 138
- Potassium, 77
- Poynting vector, xix, 36–38, 390, 805, 810, 811
- Poynting, John Henry, 36
- Prévost's law, 5
- Prandtl number, xix, 741
- Prefactor, fractal, 422, 424
- Pressure, xix
 - correction chart, 365
 - correction factor, 365
 - effective, 352, 365
 - partial, 317
 - partial, of absorbing gas, 320, 364
 - photon, 17
 - radiation, xix, 17–18, 297
 - solar, 18
- Pressure path length, 320
- Principle of invariance, 475
- Probability, 756
- Probability density function, xviii, 252, 706, 754, 756, 758
- Probability distribution, 248
- Profilometer, 89
- Property, radiative, *see* Radiative properties
- Pseudorandom number, 250
- Pulverized coal, 706
- Pyroelectric detector, 109
- Pyrometer, 30

- Quadrature, numerical, 179, 181, 542
- Quantum detector, 109
- Quantum mechanics, 3
- Quantum number
 - rotational, xviii, 309
 - vibrational, xx, 310, 352
- Quartz, 7, 112, 442, 761
- Quasi-Newton method, 789–792, 794

- RADCAL database, 333, 860
- Radiation
 - background, 450
 - external, 216
 - from isolated lines, 320
 - midinfrared, 4
 - monochromatic, 6
 - sky, 216
 - transient, 619–622
 - ultraviolet, 4, 76, 94, 98
 - visible, 3, 4, 18–19
- Radiation energy density, xx, 292
- Radiation pressure, xix, 17–18, 297
- Radiation shield, 176–178, 215–216

- Radiation tunneling, 805
- Radiation–turbulence interaction, 753–759
- Radiative combination, 304
- Radiative conductivity, 483
- Radiative equilibrium, 298, 571
 - between concentric cylinders, 474, 508
 - between concentric spheres, 469–471
 - in a gray medium, 705
 - in a nongray gas slab, 636, 639–643
 - in a nongray medium, 647, 706
 - in a nonscattering slab, 461–465
 - in a scattering slab, 466–467, 547–548, 568–569
- Radiative heat flux, 13, 15–17, 66, 292–293
 - divergence of, 293–295
 - for a cylindrical medium, 473
 - for a plane-parallel medium, 458
 - for a spherical medium, 469
- Radiative heat transfer, 1
- Radiative intensity, *see* Intensity, 13–15
- Radiative properties, 3, 28
 - definitions for surfaces, 62–72
 - directional, 22
 - hemispherical, 22
 - of coal particles, 415–418
 - of fly ash, 415–418
 - of gases, 23–24, 303–386
 - of materials, 2
 - of metals, 75–83
 - of nonconductors, 83–89
 - of particles, 25–26, 387–439
 - of selective absorbers, 103
 - of semitransparent media, 24–25, 440–450
 - of semitransparent sheets, 95–101
 - of soot, 418–425
 - of window glass, 95
 - spectral, 22
 - summary for surfaces, 72, 73
 - temperature dependence, 78–79, 82–83, 88–89, 600
 - total, 22
- Radiative resistance, xix, 173, 174, 214
- Radiative source, xix, 27, 285, 455
 - for anisotropic scattering, 457
 - for isotropic scattering, 456
 - for linear-anisotropic scattering, 457
 - modified, 558
 - time-averaged, 754
- Radiative transfer equation, 320, 454
- Radiative transfer equation (RTE), 26–27, 279–292
 - boundary conditions, 288
 - integral formulation, 295–297
 - solution methods, 299
- Radiative transport theory, 27–28
- Radiosity, xviii, 165, 200, 202
 - artificial, 587
 - for a semitransparent wall, 217
 - spectral, 166
 - volume zone, 597
- Radiosity equation, 166, 168, 178, 203
- Raman effect, 387
- Random number, xix, 247, 249
- Random number generators, 250
- Random number relation
 - for absorption, 697, 700
 - for absorption and reflection, 257

- for direction of emission, 256, 696
 - for point of emission, 254, 696
 - for scattering, 698
 - for wavelength of emission, 256, 696, 700
- inversion, 262
- Ray effect, 560, 570–572
- Ray model, 707, 708
- Ray tracing, 95, 99, 200, 259–261
- Rayleigh scattering, 26, 393, 398–401, 423, 611
- Rayleigh, John William Strutt, Lord, 6
- Rayleigh–Debye–Gans scattering, 423
- Rayleigh–Gans scattering, 393, 401
- Rayleigh–Jeans distribution, 9
- Reaction mechanism, 749
- Reactive flow, 756
- Reciprocity, *see* Law of reciprocity
- Reflectance, 21, 68–72
 - bidirectional, 68
 - components of, 197
 - diffuse, 69
 - of silicon carbide, 88
 - spectral, directional
 - of platinum, 80
 - spectral, directional–hemispherical, 69
 - spectral, hemispherical, 71
 - spectral, hemispherical–directional, 71
 - spectral, normal
 - of magnesium oxide, 89
 - of silicon, 85
 - total, directional–hemispherical, 72
 - total, hemispherical, 72
 - total, hemispherical–directional, 72
 - total, normal, 78
- Reflection, 25, 42–57, 387
 - by a slab, 53–57
 - by a thin film, 53–56
 - from large spheres, 402
 - gray, diffuse, 129
 - irregular, 222
 - specular, 45, 69, 197
- Reflection coefficient, xix, 47–49, 51, 448, 808
 - for a thin film, 54
- Reflection function
 - bidirectional, 198, 235, 238
 - spectral, 68
 - total, 71
- Reflection measurement, 113–118
- Reflection technique, 447
- Reflectivity, xxi, *see also* Reflectance, 47
 - coating, 98
 - for polarized light, 79
 - interface, 48, 49, 51, 52
 - of a dielectric thin film, 55
 - of a slab, 450
 - of a thick slab, 56, 96
 - of a thin film, 54, 56
 - of aluminum, 52
 - spectral, directional, 79
 - spectral, directional, polarized
 - of glass, 87
 - spectral, normal, 83, 85
 - of aluminum, 76
 - of an In₂O₃ film on glass, 99
 - of copper, 76
 - of magnesium oxide, 84
 - of metals, 75
 - of silicon carbide, 84
 - of silver, 76, 78
- Reflectometer
 - heated cavity, 115
 - integrating mirror, 117
 - integrating sphere, 116
- Reflector
 - diffuse, 70
 - perfect, 71
 - specular, 69, 73
- Refraction, 25, 387
 - in large spheres, 402
- Refraction angle, 45
- Refractive index, xix, 3, 35, 290
 - for semitransparent materials, 85, 86
 - of air, 3
 - of vacuum, 3
 - varying, 612
- Refractive index function, xvii, 419
- Regularization, 779, 785–787
 - parameter, xxi, 787, 792
- Relaxation parameter, 274
- Relaxation time, 76, 77
- Resistance, radiative, xix, 173, 174, 214
- Resistivity, electrical, 76
- Resonance frequency, 59
- Reststrahlen band, 84, 86, 88, 441, 442
- Reticulated porous ceramics, 446, 447, 450, 760, 761
- RevMCcs, 719
- RevMCxx, 860
- Reynolds number, xix, 741
- Rigid rotator, 309, 311, 314
- Ripple, 398
- rnarray, 860
- Rosseland approximation, 483, 761–763
- Rosseland-mean absorption coefficient, 368, 635
 - for coal particles, 416, 417
 - for particles, 395
 - for soot, 424
- Rosseland-mean extinction coefficient, 446, 483, 634
 - for coal particles, 416, 417
 - for particles, 395
 - for soot, 424
- Rotation matrix, xx, 513
- Rotational energy level, 304, 308
- Rotational quantum number, xviii, 309
- Rotator, rigid, 309, 311, 314
- Roughness
 - root-mean-square, xxi, 89, 91
 - surface, 69, 89–93
- RPC, *see* Reticulated porous ceramics
- RTE (Radiative transfer equation), *see* Radiative transfer equation (RTE)
- Sandia Flame D, 533, 668, 757, 758
- Sapphire, 112, 761, 815
- Saturable absorption, 612
- Scaled *k*-distribution
 - global, 661
 - narrow band, 345
- Scaling approximation, 346, 654
- Scaling function, xx, 345, 660

- Scanning tunneling microscope, 815
- Scattering, 25, 26, 299
 - attenuation by, 281
 - augmentation by, 282–283
 - by fibers, 409, 450
 - by nonspherical particles, 422
 - dependent, 388
 - elastic, 387
 - false, 560
 - independent, 388
 - inelastic or Raman, 387
 - isotropic, 283, 287, 299, 391, 411
 - linear-anisotropic, 299, 411
 - multiple, 427
 - Rayleigh, 393, 398–401, 611
 - Rayleigh–Gans, 393, 401
 - single, 427
- Scattering albedo, xxi, 26, 27, 285
- Scattering angle, xxi, 391
- Scattering coefficient, xxi, 25, 281
 - for a particle cloud, 394, 395
- Scattering cross-section, 389
- Scattering efficiency factor, 389
 - for absorbing spheres, 393
 - for long cylinders, 409
 - for specularly reflecting spheres, 404
- Scattering measurement, 427
- Scattering peak, 393, 397, 401, 407, 410, 412
- Scattering phase function, *see* Phase function
- Scattering photometer, 426
- Scattering regimes, 389
- Schrödinger's wave equation, 308, 310
- Schuster–Schwarzschild approximation, 299, 486–488, 548, 574
- Search direction, 788, 792, 794
- Search step size, 788, 793, 794
- Selection rule, 309, 310
- Selective surface, 101, 102, 207, 229
- Self-broadening coefficient, xvii
- Self-correlation
 - Planck function, 757
 - temperature, 755, 756
- Semiconductor, 58, 83, 84
- semigray, 232, 246, 857
- Semigray approximation, 230, 233, 242, 634–637
- semi $grxch$, 232, 246, 857
- Semitransparent, 4
- Semitransparent liquid, 442
- Semitransparent medium, 85, 440–450, 733–738
- Semitransparent sheet, 74, 216–219
- Semitransparent surface, 216–219
- Semitransparent wall, 202, 290
- Semitransparent window, 216–219, 761
- Sensitivity matrix, xx, 781, 782, 784, 793, 796
- Shading, partial, 208
- Shadowing, 91
- Shape factor, *see* View factor, 131
- Sheet, semitransparent, 74, 216–219
- Shield, radiation, 176–178, 215–216
- Signal velocity, 36, 619
- Silica, 94, 760
- Silicon, 85, 112, 795
 - absorption coefficient, 442
 - phosphorus-doped, 442
- Silicon carbide, 83, 88, 89, 94, 760, 813
- Silver, 76, 77
- Simplified P_N -approximation, 522–526
- Simulated annealing, 795
- Single scattering albedo, *see* Scattering albedo
- Singular value, 783, 785
- Singular value decomposition, 783
 - truncated, 785
- Six-flux method, 299, 488, 575
- Size parameter, xx, 26, 388
- Sky radiation, 216
- Skylight, 217
- Slab, *see* Plane-parallel medium
 - reflection by, 53–57
 - transmission through, 53–57
- Slab absorptivity, xvii, 96
- Slab band absorptance, 648
- Slab reflectivity, xix, 96
 - spectral, normal
 - for several glass panes, 97
 - of soda–lime glass, 97
- Slab transmissivity, xx, 96
 - spectral, normal
 - for several glass panes, 97
 - of soda–lime glass, 97
- Slag, 450
- SLW method, 654, 659, 664, 672, 673, 743
- S_N -approximation, 541–576
- Snell's law, 45, 290, 805
 - generalized, 51, 73
- Soda–lime glass, 97
- Sodium, 77
- Solar absorptance, 103
- Solar cell, 109
- Solar collector, 101, 102
- Solar concentration ratio, 759
- Solar constant, 17
- Solar energy, 2
- Solar furnace, 762
- Solar irradiation, 6, 611, 759
 - concentrated, 759–763
- Solar pressure, 18
- Solar reactor, 760
- Solar receiver, 760
- Solar sail, 18
- Solar temperature, 8, 11, 17, 19
- Solar transmittance, 103
- Solid
 - amorphous, 89, 442
 - high-temperature, 448
 - semitransparent, 440
- Solid angle, xxi, 11–13
 - infinitesimal, 12
 - overhang, 571
 - total, 12
- Solidification, 733–738
- Soot, 398, 415, 651, 652, 685
 - aggregate, 414, 422
 - cylindrical, 422
 - size distribution, 424
- Soot model, 758
- Soot properties, 418–425, 428
- Soot radiation, 750
- Source, radiative, *see* Radiative source

- Space radiator, 268
- SPECAIR database, 323
- Special surfaces, 101–104
- Species concentration, 752
- Spectral line, 304, 308, 315
 - strength, 313
- Spectral models, 325
- Spectral range, 231
- Spectral variable, xx, 7, 279, 309
- Spectral window, 24, 604, 640, 650
- Spectrometer, 108, 426, 428, 448
- Spectroscopic database, 322
- Spectrum
 - electromagnetic wave, 3, 4
 - of the sun, 6
 - vibration–rotation band, 312
- Specular direction, 69, 236, 289
- Specular peak, 69
- Specular reflection, 45, 69, 197
 - paths, 198
 - peak, 197
- Specular reflector, 69, 73
- Specular view factor, xviii, 131, 198–202, 230
- Specularity index, 421
- Speed of light, xvii, 3, 20
 - in vacuum, 3, 35
- Sphere
 - integrating, 426, 430
 - large, diffusely reflecting, 406
 - large, opaque, 402, 762
 - large, specularly reflecting, 403
 - near-dielectric, 401
- Spheres, concentric
 - at radiative equilibrium, 470
 - discrete ordinates method, 550–554
 - without participating medium, 163, 170, 176, 201, 205
- Spherical harmonics, xx, 491, 496
- Spherical harmonics method, 300, 495–534
- Spherical medium, 467–471
 - discrete ordinates method, 550–554
 - isothermal, 286, 292, 295
 - isothermal, nongray gas, 633
- Spherical top, 308
- Spline, 475
- SPRADIAN database, 323
- Stabilization, 779
- Stanton number, xix, 273
- Stark broadening, 316, 317
- Stark effect, 318
- Stark number, xix
- Statistical error, 248
- Statistical model, 327, 329–331
 - general, 351
 - rough surface, 92
- Statistical sampling, 247
- Statistical uncertainty, 780
- Steepest descent, 789, 794
- Stefan number, xix, 737
- Stefan, Josef, 10
- Stefan–Boltzmann constant, xxi, 10
- Step scheme, 559
- Step size, 789
- Stepwise-gray model, 637–643
- Steradian, 12
- Stimulated emission, 315
- Stochastic particle, 706
- Stokes' parameter, xviii, 40–42
 - for polarization, xix, xx
- Stokes' theorem, 43, 138, 139
- Successive approximation, method of, 179
- Sulfur dioxide, 352, 353, 369
- Summation relation
 - for exchange factors, 253
 - for specular view factors, 200, 203
 - for view factors, 134
- Sun, *see* Solar
- Surface
 - artificial, 130, 164
 - black, 5
 - concave, 134
 - convex, 134, 147, 170
 - curved, 199, 213, 221
 - cylindrical, 187
 - directionally nonideal, 234–242
 - flat, 134
 - fractal, 91
 - gray, 64
 - gray, diffuse, 64, 160, 165, 288
 - grooved, 105
 - ideal, 102, 129
 - isotropic, 63
 - nongray, 230
 - nonideal, 229–246, 289
 - opaque, 5, 11, 21–22, 61
 - optically smooth, 45, 69, 78, 197
 - polished, 78
 - rough, 222
 - selective, 101, 102, 207, 229
 - semitransparent, 216–219
 - solar collector, 101
 - specularly reflecting, 197, 289
 - V-grooved, 104, 105, 211, 212, 222, 236
 - vector description, 258
- Surface coating, 95
- Surface damage, 93–94
- Surface integration, 134
- Surface layer, 79, 84, 93
- Surface modification, 94
- Surface normal, xix, 12, 131, 135, 138
- Surface phonon polaritons, 807
- Surface plasmons, 807
- Surface polaritons, 807, 808
- Surface preparation, 76
- Surface radiosity, 165
- Surface roughness, 69, 89–93
- Surface waves, 807
- Suspension, particle, 427, 428, 646, 706, 746
- Symmetric top, 308
- Symmetry number, 315
- T-matrix method, cluster, 414
- Tables:
 - apparent emittance for cylindrical cavities, 180
 - associate Legendre polynomial half-moments $P_{n,j}^m$, 515
 - blackbody emissive powers, 833

- coefficients for full spectrum k -distributions, 670, 671
 - comparison of different Monte Carlo implementations, 720
 - conversion factors, 819
 - discrete ordinates (one-dimensional), 546
 - discrete ordinates (three-dimensional), 545
 - Drude parameters for metals, 77
 - exponential integrals, 854
 - mean beam lengths, 632
 - narrow band correlations, 331
 - optical properties of coal and ash, 415
 - physical constants, 818
 - radiative equilibrium
 - between concentric cylinders, 474
 - between concentric spheres, 470
 - in a plane-parallel medium, 463
 - radiative heat flux
 - from an isothermal cylinder, 473
 - radiative properties of coal particles, 417
 - spectral, normal emittances of metals, 831, 832
 - Stokes' parameters for polarization, 41
 - total emissivity correlation for CO₂, 366
 - total emissivity correlation for H₂O, 366
 - total, normal emittances, 821, 823
 - total, normal emittances of metals, 830
 - total, normal solar absorptances, 821
 - view factor catalogue, 836
 - weighted-sum-of-gray-gases coefficients, 652
 - wide band model correlation, 351
 - wide band model parameters, 353
- TE wave, 40
- Temperature
 - bulk, 272
 - Planck-mean, 666
 - solar, 8, 11, 17, 19
- Temperature dependence
 - of radiative properties, 82, 88
- Temperature discontinuity, 462
- Temperature measurement
 - of gases, 370
- Thermal conductivity, xviii, 2
- Thermal detector, 109
- Thermal radiation, 1, 2, 4, 28
- Thermal runaway, 370
- Thermopile, 109
- Thick film, 56
- Thin eddy approximation, 755, 756
- Thin film, 53, 447
 - reflectivity, 56
 - transmission through, 53–56
- Thin film optics, 53
- Thin layer, 93
- Tikhonov regularization, 780, 785, 787, 792, 794–796
- Titanium dioxide, 94, 430
- TM wave, 40
- Tomography, 445, 796
- totabsor, 366, 858
- totem, 856
- totemiss, 366, 367, 633, 858
- Transient radiation, 619–622
- Transition
 - bound electron, 76
 - bound-bound, 23, 303
 - bound-free, 23, 304, 312
 - electronic, 86, 442
 - forbidden, 312
 - free-bound, 23
 - free-free, 23, 304, 312
 - interband, 58
 - vibrational, 83, 84
- Translucent, 4, 154
- Transmission, 42–57
 - through a slab, 53–57
- Transmission coefficient, xix, 47
 - for a thin film, 54
- Transmission measurement, 369, 428
- Transmission method, 447, 449
- Transmissivity, xxi, *see also* Transmittance, 48, 85
 - full spectrum, 675
 - narrow band, 336
 - of a dielectric thin film, 55
 - of a fictitious gas, 348
 - of a gas layer, 24
 - of a material layer, 25
 - of a nonhomogeneous layer, 334, 345
 - of a slab, 450
 - of a thick slab, 56, 96
 - of a thin film, 54
 - of a thin gap, 806
 - of an In₂O₃ film on glass, 99
 - of multiple glass sheets, 101
 - of window glass, 96
 - vacuum gap, 807
- Transmittance, 21, 22
 - solar, 103
- Transparent, 4
- Transparent medium, 462
- transPN, 621, 622, 859
- Transverse electric, 40
- Transverse magnetic, 40
- TRI, *see* Turbulence–radiation interaction
- Truncated singular value decomposition, 780, 796
- Tunneling, of radiation, 805
- Turbulence
 - interaction with radiation, 753–759
- Turbulence model, 753, 754
- Turbulence moment, 754
- Turbulence–radiation interaction, 753–759
- Turbulent diffusivity, 754
- Two-flux approximation, 299, 488, 574, 760
- Ultraviolet radiation, 4, 76, 94, 98, 304, 442
- Uncertainty, statistical, 780
- Unit sphere method, 135
- Unit tensor, 140, 503, 589
- Unit vector, 135
 - for direction, xix, 11, 36, 260, 456
 - surface normal, xix, 12, 258
 - surface tangent, 258
- Unity tensor, 781
- V-groove, 104, 105, 211, 212, 222, 236
- Vacuum, 129
- Van Royen, Willebrord van Snel, 45
- Variance, 251, 780
- Variational calculus, 179
- Velocity, xx, 297

- mean, 272
- phase, 34, 36, 401
- signal, 36, 619
- Vibration ellipse, 38
- Vibration, lattice, 58, 88
- Vibration–rotation band, 24, 304, 308, 311
 - spectrum, 312
- Vibrational energy level, 83, 304, 308, 310, 312
- Vibrational quantum number, 310, 352
- Vibrational transition, 83, 84
- view, 134, 146, 159, 836
- View factor, xviii, 129
 - by area integration, 135
 - by contour integration, 138
 - by crossed-strings method, 147
 - by inside sphere method, 151
 - by unit sphere method, 153
 - catalogue, 836–846
 - definition of, 131
 - diffuse, 131
 - evaluation methods, 134
 - specular, xviii, 131, 198–202, 230
- View factor algebra, 134, 143
- view.cpp, 856
- view.m, 856
- VIEW3D, 860
- viewfactors, 134, 159, 836, 856
- Visible radiation, 3, 4, 18–19, 443
- voigt, 319, 858
- Voigt broadening, 319
- Voigt profile, 319
- Volume fraction, 395, 399
 - of particles, 388

- Wall, semitransparent, 202, 290
- wangwbm, 357, 858
- Water, 443
- Water droplets, 410–412
- Water vapor, 351, 353–355, 360, 364, 365, 651, 652, 654, 655, 662, 669, 670, 677
 - Planck-mean absorption coefficient, 368
 - total emissivity, 364, 366
- Wave
 - homogeneous, 34
 - inhomogeneous, 34
 - plane, 33, 38, 44
- Wave equation, Schrödinger’s, 308
- Wave interference, 53, 56, 98, 99, 103
- Wave vector, xx, 33, 804
 - for transmission, 50
- Wavefront, 44
- Wavelength, xxi, 3
 - crossover, 82
 - cutoff, 102
- Wavenumber, xx, 3, 33
 - cumulative, 665
 - reordered, 658
- wbmkvsg, 361, 858
- wbmodels, 357, 858
- wbmxxx, 354, 858
- Weight factor (for WSGG), 650, 652, 654
- Weight function, 708
- Weight function (for FSK), 659, 661, 664, 666–668, 681
- Weighted sum of gray gases, 603, 649–654, 743

- Weighting matrix, xx
- Wide band model, 326, 349–362
 - exponential, 350
 - for isothermal media, 647–649
- Wien’s displacement law, 8, 814
- Wien’s distribution, 9, 10, 307
- Wien’s law, 9
- Wien, Wilhelm, 7
- Wigner-*D* functions, xvii, 513
- Window, 95, 449
 - semitransparent, 216–219, 761
 - spectral, 604, 640, 650
- Window glass
 - absorption coefficient, 442
- WSGG, *see* Weighted sum of gray gases

- YIX method, 575

- Zenith angle, 6
- Zinc oxide, 762
- Zinc selenide, 371
- Zirconia, 760
- Zirconium carbide, 89
- Zonal method, 300, 585–609