

Index

- additive invariants, 29
- heat flux, 32
- pressure tensor, 31
- affinity, 170
- Allen–Cahn equation, 353, 494–495
- anomalous diffusion, 106, 118
- Arrhenius formula, 86
- ASEP model, 224
- asymmetric exclusion process (ASEP), 284
- Bak–Tang–Wiesenfeld (BTW) model, 267
- Becker–Döring theory, 364
- Bénard–Marangoni instability, 406
- binary alloy, 325, 335, 337, 431
- binary mixture, 203
- Boltzmann transport equation, 17
 - hydrodynamics, 32
 - continuity equation, 38
 - first-order approximation, 34, 424
 - heat equation, 38
 - Navier–Stokes equation, 38
- bridge model, 231, 489
- Brownian motion, 41
 - Einstein theory, 43
 - Fokker–Planck equation, 50
 - generalized, 146
 - Langevin equation, 47
 - sedimentation equilibrium, 44
- Brusselator model, 385–387
- Burgers equation, 303, 440
- Cahn–Hilliard (CH) equation, 331, 376, 392
- cellular automaton (CA), 245
- Central Limit Theorem (CLT), 94
- Chapman–Kolmogorov equation
 - continuous time, 83, 448
 - discrete time, 54
- classical nucleation theory, 362–364
- coarsening, 325, 326, 338, 354, 372, 393, 403
- contact processes, 249, 257
- Cramer function, 99, 100, 138
- critical exponents
 - equilibrium
 - Fisher scaling law, 213, 216
 - Ising, 211
 - Josephson scaling law, 212, 215
- mean-field (MF), 202, 211
- Rushbrooke scaling law, 214, 216
- Widom scaling law, 214, 216
- nonequilibrium
 - compact percolation, 260
 - directed percolation, 250–254
 - mean-field (MF), 259
- damped harmonic oscillator, 156, 507
- deposition models, 278
- detailed balance, 63, 66, 68, 69, 74, 136, 365, 429
- diffusion equation, 51, 348
 - Fourier–Laplace transform, 453–455
 - general solution, 452–453
- diffusion limited aggregation (DLA) model, 315
- directed percolation (DP), 243
 - compact (CDP), 259
 - mean-field (MF) theory, 256–259
- Domany–Kinzel (DK) model, 245–249
- dynamical percolation (DyP), 262
- Eckhaus instability, 399–403
- Edwards–Wilkinson (EW) equation, 288, 290–299
- Einstein formula, 44
- Einstein’s theory of fluctuations, 121
- electric conductivity, 186, 193
 - quantum field theory (QFT), 466
- entropy, 19, 122, 170
 - entropy production rate, 172
 - variational principle, 175–177
- envelope equation, 395
- equipartition theorem, 48
- Ettinghausen effect, 195
- extreme value statistics, 103
- Family–Vicsek scaling, 275
- first exit time, 86
- fluctuation theorems, 130, 135
- fluctuation–dissipation relation, 48, 150, 464
- Fokker–Planck equation, 50–52, 83–85
 - conservation law (as), 78
 - general, 76–78
 - growth models, 305
 - particle with a mechanical force, 82
 - stationary solution
 - absorbing barriers, 78

- growth models, 306
- mechanical force, 83
- Fredholm alternative theorem, 509
- free energy, 124, 204
- functional derivative, 443–445
- Galilean transformation, 303
- galvanomagnetic effect, 192
- Gibbs distribution, 68
- Gibbs relation, 171
- Gibbs–Thomson relation, 496–497
- Ginzburg criterion, 210, 258
- Ginzburg–Landau (GL) free energy, 207, 331, 393, 477–479
- Glauber dynamics, 335, 344, 432
- grass model, 313
- Green–Kubo relation, 160–165
- Gutenberg–Richter law, 264
- Hall effect, 195
- heat conductivity, 9, 186, 194
- Herring–Mullins equation, 295
- H-Theorem
 - non-uniform case, 22
 - uniform case, 18
- ideal gas, 4, 416
 - distribution function, 11
 - mean free path, 6
- Ising model, 203–206, 431–439
- Itô formula, 76
- Jarzynski equality, 127
- Kardar–Parisi–Zhang (KPZ) equation, 288, 299–301
 - deterministic (dKPZ), 440–443
 - experimental results, 310
 - renormalization group (RG), 480
- Katz–Lebowitz–Spohn (KLS) model, 222
- Kawasaki dynamics, 336, 351, 432
- kinetic theory, 4
- Kolmogorov equation
 - backward, 85, 448
 - forward, 85
- Kramers–Kronig relations, 154, 167, 471
- Kramers–Moyal expansion, 448–449
- Kubo formula, 144
- Landau theory of critical phenomena, 206
- Langevin equation, 47–50
- large deviations, 97
- lattice gas (LG), 203, 432
 - driven (DLG), 223
- Lévy flights, 114
- Lévy walks (LW), 115
- linear response theory, 141
- Lorentzian distribution, 97
- Lyapunov functional, 306, 375, 393
- Markov chains, 52–63
 - ergodicity, 61, 429
- master equation
 - Brownian particle, 50
 - continuous time, 68
- Maxwell construction, 202, 323, 475
- Maxwell distribution, 5
- Maxwell–Boltzmann distribution, 20, 414
- mechanochemical effect, 180
- Metropolis algorithm, 66
- Monte Carlo
 - kinetic (KMC), 492
 - method, 64
- multiscale analysis, 507–509
- Nernst effect, 195
- nonequilibrium steady state (NESS), 68
- Onsager matrix, 174
- Onsager reciprocity relation, 173, 180
- Onsager regression relation, 167
- Onsager theorem, 184
- Ornstein–Uhlenbeck process, 81
- Ornstein–Zernike form, 210
- Ostwald ripening, 350
- parity-conserving (PC) model, 263
- pattern formation, 370–408
 - linear stability analysis, 374–380
 - periodic steady states, 387–393
 - weakly nonlinear analysis, 390–393
- Peltier effect, 189
- phase diffusion equation, 402, 405
- Prandtl number, 501
- quenching, 325
- random matrices, 104
- random walk, 44, 452
 - with absorbing barriers, 58
 - continuous time (CTRW), 66, 107
 - subdiffusion, 107, 111
 - superdiffusion, 107, 114
 - generalized, 106
 - momenta, 455
 - on a ring, 56
 - with a trap
 - anisotropic, 457
 - isotropic, 456
- Rayleigh number, 501
- Rayleigh–Bénard instability, 371, 498–503
- reaction–diffusion equations, 381
- renormalization group (RG)
 - equilibrium, 216, 432–439

- renormalization group (RG) (cont.)
 nonequilibrium, 300
response function, 152
 generalized, 165
 mathematical properties, 469–472
 quantum, 460
Righi–Leduc effect, 195
roughness, 274
 critical exponents, 275, 293, 302, 305
scale invariance, 211, 216, 254, 283
scaling theory
 equilibrium, 214
 nonequilibrium, 254
Seebeck effect, 187
self-affinity, 283
self-organized criticality (SOC), 264
single step model, 283
specific heat, 9, 119, 126, 202
stochastic differential equations, 70
 Ito and Stratonovich, 73, 446
stochastic matrices, 54
 spectral properties, 427–428
stochastic processes
 continuous time, 66
 discrete time, 52, 66
stochastic thermodynamics, 126
Stokes’s law, 43
susceptibility
 harmonic oscillator, 157
linear response, 150, 155, 461
magnetic, 205
Swift–Hohenberg (SH) equation, 388
TASEP model, 224
mean-field (MF), 486
Tauberian theorems, 113
thermoelectric effect, 184
thermomagnetic effect, 192
thermomechanical effect, 180
Thomson–Joule effect, 190
time-dependent Ginzburg–Landau (TDGL) equation, 331, 375
steady states $d = 1$, 506
Tracy–Widom (TW) distribution, 105, 308
transport
 charged particles, 184
 coefficients, 7, 164
 coupled, 182
 quantum, 466
Turing instability, 380–387
 general conditions, 504–505
 linear stability analysis, 381
van der Waals gas, 200, 473
van ’t Hoff law, 42
Wiener process, 71
Wiener–Khinchin theorem, 153