

Index

- active random walk models, 182–3
 active zone, 143, 178, 184, 194, 195, 200–1,
 204–7, 210, 213, 232, 245, 279, 291, 318,
 338, 395, 402, 422–5, 556
 active zone width, 184, 187, 200–1, 204–7, 279,
 330, 419, 565
 adsorbtion, 501–2
 aggregation, 59, 111, 369
 cluster–cluster, 60, 105–7, 209, 399–400, 594
 convection-limited, 258
 diffusion-limited, *see* DLA
 algorithmic modeling, 14, 52, 190, 260, 525
 ammonium bromide, 36
 ammonium chloride, 27, 360–2, 485–6
 amplitude ratios, universal, 217
 amplitude universality, 137, 414
 amplitudes, 5–7, 137, 204, 217, 256, 414, 497,
 517
 anisotropy, 46, 54, 57, 243–7, 266, 275–6, 291,
 293, 295, 346, 360
 annealed disorder, 295
 anodic dissolution, 428
 anti-Schwoebel barriers, 545
Archaeopteryx, 328
 arcing defects, 363
 arrest fronts, 468–74
 Arrhenius dynamics, 414, 540, 544
 Arrhenius rate equation, 353, 413–4, 495, 540–1
 associated processes, 471
 atomic force microscopy, 397–9, 475–6, 486,
 498–500, 509, 514–15, 517, 519, 542
 attractive interaction model, 269–2
 effects on diffusion fronts, 239
 attractors, 17
 avalanches, 471
 averages
 annealed, 605–6
 quenched, 605–6
Bacillus subtilis, 483
 backbones, 218, 220, 233, 330, 382, 395, 470
 elastic, 219–20
 ballistic aggregation models, 187–9, 253, 301
 ballistic deposition
 correlated, 440, 441
 grazing incidence, 553, 560
 ballistic deposition models, 136–7, 139, 142,
 144, 407–8, 419–25, 431, 435, 436, 442, 497,
 520, 535, 549, 553–61
 grazing incidence, 553
 oblique incidence, 553–61
 ballistic fans, 561–3
 Belousov–Zhabotinsky reaction, 31
 bifurcations, 17–19
 biharmonic equation, 197
 binning, 101–2, 149
 biological processes, 159, 483
 blood vessels, 93–4

- Bond number, 12, 88
- boundary integral method, 314
- boundary layer, 54–6, 371
- boundary layer model, 54–6
- box counting analysis, 80, 99, 118, 151–2, 362
- branching mechanisms, 362
- bridge method, 141, 149
- Brownian coalescence, 555–7
- Brownian motion, 110, 557
 - fractional, 124–7
 - process, 124, 152–3, 429
 - universality class, 159
- Burgers' equation, 415
- burning algorithms, 219–20

- cancer, 184–5
- Cantor bar, 81
- Cantor set, 65–7, 70–2, 81, 119–21, 324
- capillary length, 41, 46, 53, 381, 517, 575–81
 - chemical, 41
 - thermal, 41
- capillary number, 342–4, 385, 389, 477, 480–2, 583
 - anisotropy, 46
 - pore level, 480
- cascade models, 3
- Cauchy number, 8
- cell colonies, 483
- cellular patterns, 27–31, 43
- channel networks, 347, 395
 - percolating, 395
 - random, 347–9, 361, 384, 395–6
- chaos, 17, 34
- characteristic lengths, 6, 40–5, 50, 105, 262, 376
- chemical fronts, 261
- chemical mobility, 42
- chemical potential, 38–9, 42, 380, 408, 409, 525, 546
- chemical vapor deposition, 498–9
- chemotaxis, 183
- chiral lipids, 356
- clay, 389–93
- cluster
 - fjords in, 308, 603
 - growth models, 183–214
 - perimeters, 170–3, 220
 - external, 86, 171–2, 220–1, 229
 - size distribution, 554
 - surfaces, 169–72
- coarse-graining, 108–9
- coastline analysis, 144–5, 152, 167, 225, 484
- codimensionality, 75, 105–6, 144, 273, 338
- colloidal aggregates, 83, 107
- colloidal materials, 389–93
- columnar morphology, 25, 28, 421, 497–8, 501–3, 516, 520, 543, 552–61, 565–7
- combustion fronts, 482
- competitive growth, 281–5, 320, 567–9
- complex fluids, 388
- complexity, 57
- conductivity, 166, 218, 317, 330, 369–70, 499
 - anisotropy, 370
- conductivity exponent, 166, 330
- conductivity ratio, 369–70
- confocal microscopy, 476
- conformal invariance, 224
- conformal mapping, 283–5, 306, 309, 312–13, 322
- connectivity, 116, 169, 215–16, 382
- contour analysis, 146
- control parameters, 378, 389
- convection, 27–8, 31–7, 338, 360, 373
 - Rayleigh–Bénard, 27–8, 32–6
- correlation functions, 74–7, 91, 228, 464–5, 482–3, 543–4, 595–7
 - density–density, 74–6, 94–100, 104–7, 144, 198, 208, 257, 259, 272, 362, 385, 399, 487
 - height difference, 130–5, 138, 154, 414, 447, 457, 464–5, 478, 487, 490, 493, 511, 531, 547
 - height–height, 138, 477, 487, 507–8, 511
- correlation length exponents, 218, 226, 235, 388
- correlation lengths, 88, 91, 108, 131–2, 217, 402
 - parallel, 131–4, 137–41, 153, 402
 - perpendicular, 131–4, 137–41, 153, 402
- correlation volume, 228
- correlations, 14,
 - angular, 201–2
 - density, 237
 - lateral, 406
 - persistent and antipersistent, 129, 155–9
 - vector, 208–9, 272
- corrosion, 402, 518–19
 - pitting, 518–19
- cosmic rays, 13
- cosmology, 3, 404
- Coulomb interaction, 271
- cratering, 6–12
- creeping flow, 357
- critical phenomena, 107–10
- critical points, 15, 107, 239

- crossovers, 6–8, 14, 75, 80, 85–100, 107, 110,
 143, 152–5, 157–8, 181, 211, 230, 234, 256,
 259, 262, 266, 272, 339, 363, 396, 369,
 378–9, 389, 396, 398, 412, 435, 447, 456,
 458, 461–2, 479, 490, 496, 513, 519, 526,
 531, 541, 559
 resolution dependent, 93–100
 scaling of, 225
 crystallization, 360, 375, 382
 cumulative distributions, 101
 curdling, 82, 586
 cut-off lengths, 80, 85, 131, 148, 434
 cut-off scaling, 131–4
 cut-offs, 102, 106, 148, 273
 cuts through fractals, 84, 102–3, 144–9, 201–2,
 278–9, 309–10

 Darcy equation, 269, 357–9, 580
 Das Sarma–Tamborenea models, 528, 533–4,
 536, 540, 549
 data analysis, 4, 7, 14, 80–1, 101–2, 148, 154,
 157, 476
 data collapse, 94, 105–6, 202–3, 213, 277
 multifractal, 592–6
 data detrending 130, 141, 149, 151, 155
 data smoothing, 149,
 Deborah number, 12, 391
 Debye screening length, 333
 Debye–Waller factor (static), 488
 defects, 27, 34, 246–51
 dendritic growth, 24, 46–8, 49, 54–7, 252, 266,
 314, 346–7, 354–5, 397, 408
 dendritic patterns, 24, 46–8, 54–7, 327–8, 347,
 397
 dendritic solidification, 42–3, 197, 404
 dense branching patterns, 56–7, 329, 363,
 366–81
 aerocolloidal systems, 366–9
 electrodeposition, 337, 369–74
 fluid–fluid displacement, 377–80
 mechanical effects, role of, 368
 radial, 24, 334, 339, 369, 371, 375, 377–8
 thin films, 375–7
 depletion zone, 371–2
 deposition
 colloidal, 508–9
 diffusion-limited, 272–9, 340
 grazing incidence, 556–61
 metal-on-metal, 351
 multilayer, 496, 504–8
 oblique incidence, 556
 sputter, 348, 350, 493, 502, 562
 vapor, 350, 375, 381, 402, 404, 498–506
 deposition experiments, 402, 486
 deposition noise, 410, 417, 525
 deposition radius, 200
 desorption, 524
 detailed balance, 413, 539–40, 546
 deterministic growth models, 288, 553, 568–9
 deterministic overflow model, 291
 Devil's staircase, 81–3
 dielectric breakdown, 179, 193, 252, 363, 364
 dielectric breakdown models, 193–8, 290, 308,
 395
 η , 336, 359
 random walk, 195
 diffusion, 26, 36–43, 375
 bulk, 512, 525
 molecular, 360
 non-Fickian, 2
 thermal, 31, 34, 360, 574
 diffusion equation, 38, 41, 235
 diffusion fronts, 234–9
 diffusion length, 26, 41–3, 259, 370–1, 381, 517,
 548, 575–80
 diffusion-limited aggregation, *see* DLA
 diffusion-limited annihilation, 211–14, 556
 diffusion-limited growth walk, 177–81, 195
 non-universality, 178–80, 195
 dimensional analysis, 9–13
 dimensionality
 capacity, 80
 critical, 78, 173, 209
 exterior capacity, 79, 114
 fracton (or spectral), 61, 330
 global, fractal, 151–2
 Hausdorff–Besokovitch, 78, 114
 information, 92, 301
 irregularity, 83
 local fractal, 113–4, 151–2, 205
 mass fractal, 339
 minimum path, 118
 Minkowski, 79
 Minkowski–Bouligand, 79
 spreading, 209, 224
 dimensionless groups, 9–12
 dimensionless ratios, 9–12, 111
 dimensionless supersaturation, 40
 dimensionless undercooling, 39, 46–8
 dipolar interactions, 271–2
 directed percolation, 239–42, 244–7, 433,
 461–75, 478, 569–72

- directed percolation (*cont.*)
 backbone, 470
 correlation length exponents, 240, 464, 478
 and faceted growth, 244–7
 and surface growth, 433–4
 threshold, 433
- directed polymers, 429–31, 438
- directed surfaces, 470
- directional solidification, 25–7
- disorder
 annealed, 295
 quenched, 87, 232, 266, 295, 342, 347–8, 360,
 433, 450–75, 478
- dissolution processes, 356–77, 428
- divider method, 152
- DLA (diffusion-limited aggregation), 57, 60,
 113, 118–19, 160, 162, 168–9, 178, 179, 189,
 215, 242–3, 250–324, 336, 339, 342, 360,
 362, 363, 366, 380, 389, 398, 402, 405, 419,
 475, 483, 547, 568
- arm length fluctuations, 308
- asymptotic aspect ratio for arms, 310
- asymptotic shape, 207, 310
- average structure, 210–11, 303
- boundary conditions, 195
- cluster arm shapes, 293
- deposition 272–9
- effects of lattice structure, 285–9, 291–5
- effects of sticking probabilities, 261–9
- exposed tip length, 312–13
- growth probability distribution, 160–2, 597,
 599–605
- homogeneous perturbations, effects of, 251,
 253–6
- inhomogeneous perturbations, effects of,
 256–69
- internal, 212
- lacunarity, 202–4, 207
- maximum number of arms in, 308
- minimum path dimensionality, 209, 234, 330
- models based on, 250, 252
- multiscaling, 204–7
- parallel algorithm for, 192
- perturbations, effects on, 169, 251, 575
- scaling structure, 198–209
- simulations, 190–2, 347
- topology, 118
- vector correlations, 208–9
- DLA, theories for, 299–324
 binary tree model, 319–22
 fixed scale transformation, 317–19
 mean field, 172, 302–6, 380
 quasi-particle model, 322
 real-space renormalization, 257, 316–19
 saw model, 313
 wedge models, 291, 306–16, 601
- DLA experiments, 327–66
 bacterial cell colonies, 483
 dielectric breakdown, 363–4
 dissolution, melting and erosion, 356–60
 electrochemical deposition, 328–42, 517
 fluid–fluid displacement, 342–8, 378, 389
 lipid monolayers, 355–6
 solidification and crystallization, 360–3
 thin films, 348–54, 398–9
- DLA-like patterns, 346, 371
- DLA models 189–98, 253, 268, 290, 301, 371,
 376, 396
 anti-DLA model, 212
 with attractive and repulsive interactions, 271
 with cluster rotation, 257–8
 high dimensionality, 297–8
 in a box, 376–7, 484,
 lattice, 211, 242, 291–5, 301
 Levy walk/Levy flight, 253–4, 319
 with multiple growth sites, 350–2, 354
 noise-reduced, 285–9, 307, 310–12
 non-zero particle density, 258–9, 362, 371, 375
 with particle drift, 256–8
 quenched disorder, 266, 268, 295–6
 radially biased, 254–6
 semi-lattice, 292–4, 307
 simplified, 279–85
 zero noise limit, 263
- domain boundaries, 459, 558–60
 coalescing, 558
- downward funneling, 535
- drainage, 386
- drift, limitless, 204
- drying, 231, 387–9
- dusty plasmas, 367
- dynamical exponent, 133, 139, 438
- ϵ -neighborhood, 203–4, 161, 205
- earthquakes, 3, 13
- Eden growth, 262, 407, 419, 460, 483
 on percolation cluster, 395, 460
- Eden model clusters 184–7
 anisotropy 243–5
- Eden models, 93–6, 142, 143, 168, 184–7, 188,
 194, 229, 242–5, 253, 301, 376–7, 407–8,
 419–20, 431, 460, 483, 485–6

- noise reduced, 244–5, 419
 off-lattice, 187
 poisoned, 230
 with trapping, 262
 Eden trees, 93–6
 Edwards–Wilkinson, *see* EW
 electrical potential, 372
 electrochemical deposition, 23, 252–3, 328–42,
 365–6, 369–74, 402, 607
 copper, 335–8, 370, 516–18
 effects of magnetic fields on, 340
 potentiostatic conditions, 336
 silver, 329, 336–9, 341
 underpotential, 339
 zinc, 329–30, 336, 341–2, 373
 electrochemical polymerization, 328
 electroconvection, 333–5, 370–1
 electroless deposition, 341
 electron diffraction, 354
 electron microscopy, 59–60, 336, 338, 367–8,
 381–2, 484, 499, 506–7, 519
 electro-osmosis, 333
 electropolishing, 212, 510
 entropy, maximum, 30
 equilibrium
 local, 25, 36, 38, 52, 55, 578
 statistical mechanics, 215
 equilibrium structures, 15
 equilibrium systems, 63, 165
 erosion, 182, 356, 358–60, 402,
 experiments, 510–16
 mechanical, 515
Escherichia coli, 483
 etching, 357, 428, 510
 models, 428, 510–14
 Euclidean geometry, 67, 84
 Euclidean patterns, 24
 Euler equation, 29–30
 eutectic solidification, 25–8
 evaporation, 505, 546
 electron beam, 383
 flash, 485
 EW (Edwards–Wilkinson) equation, 406–7, 412,
 418, 451, 455, 509, 523–4
 EW growth, 438, 497, 509, 532–3, 535–6, 542,
 552
 quenched *see* QEW equation
 EW universality class, 425–7, 435, 510, 526–7,
 539, 544–5
 exponents
 effective, 157
 Holder, 81, 163, 365, 585, 591
 measurement of, 101–3, 143
 roughness, 132–4, 406–8
 scaling relationships, 142, 279, 408, 411,
 415–17, 419–20, 449–50, 555
 universality, 414
 faceted growth, 243–7, 347, 458–9, 569–72
 Faraday magneto-optical effect, 33
 fast Fourier transformation, 128, 442
 fattening, 79
 Fibonacci sequence, 324
 field theory, 323
 finite-size effects, 14, 85, 107–8, 152–3, 345, 523
 fixed points, 17, 109, 316, 321
 fixed scale transformation, 109, 317–19
 flame fronts, 27
 Flory radius, 89
 fluctuation–dissipation relationships, 410
 fluid–fluid displacement, 44, 86–90, 231, 268–9,
 314, 342–9, 377–80, 384–97, 439, 447, 450,
 460–2, 476–83, 580–4
 effects of anisotropy on, 347–9
 with immiscible fluids, 231, 387
 with miscible fluids, 344–9, 389–93, 396
 fluid–solid phase transition, 2-dimensional, 355
 fluorescence microscopy, 355–6
 foams, 15, 28
 fluid–fluid displacement, 393
 force distribution on fractals in fluids, 593–4,
 596
 Fourier analysis, 146–7, 153, 502
 Fourier components, 209, 212, 577
 Fourier synthesis of self-affine fractals, 127
 Fourier transformation, 146, 149, 406, 443–5,
 516
 fractal aggregates, 59, 107
 fractal blob models, 88–91, 153, 216–19, 236–7,
 255–7, 260, 276, 278, 460, 480–1
 self-affine, 153, 480
 fractal dimensionality, 2–3, 5–6, 66
 effective, 345
 generalized, 164–5
 global, 151–2
 local, 113–14, 151, 152, 205
 measurement of, 74–81, 152
 fractal dusts, 144
 fractal Gaussian processes, 125–7
 fractal generators, 72, 81, 114–15, 119–23, 588
 fractal geometry, 1–3
 fractal seaweed patterns, 57, 59

- fractal subsets, 112, 160–5, 215, 218, 365, 585–91
- fractal trees, 113
- fractals, 15, 59–61, 65–167
- fat, 79
 - homogeneous, 114, 198
 - inhomogeneous, 113–64, 198
 - polymeric, 61
 - self-affine, 89, 119–59, 247, 406
 - generation of, 128
 - self-similar, 61–83, 151
 - statistically self-affine, 122, 131
- fracton dimensionality, 2, 61, 215, 330
- fractons, 2, 61, 215, 330
- fracture, 27–9, 85, 96, 233, 475
- fragmentation, 379
- froth, 28–31
 - magnetic, 31
- Froude number, 6–12
- frozen zone, 202, 318, 402
- fulgurites, 364
- galaxy
 - correlation length, 3, 91–2
 - distribution, 3, 91–3, 242
 - structure, 240
- Galilean invariance, 414–15
- Galilean transformation, 414–15
- gap size distribution, 85, 144
- Gates–Westcott model, 435
- gauge invariance, 260
- Gaussian processes, 405–6
- gels, 27, 36, 60–1, 215
- geological processes, 3, 156–9
- geometrical defects, 249
- geometrical model, 54
- Gibbs–Thompson effect, 39, 408
- grain boundaries, 484–6, 499, 520
- grass model, 563, 566
- gravity stabilized displacement, 384, 386
- Green's functions, 52, 289, 314–15, 601
- grinding, 148, 514
- growth probability distributions, 160, 306, 309, 322, 364–6
- growth probability measure, 160, 365, 597–605
- growth rate distribution, 360
- growth velocities, 24–7, 41–8, 55, 193–5, 245–6, 376, 380, 381, 388, 574
- Haines jumps, 386
- Hamiltonians, 108, 215, 382, 457, 462
- quasi-particle, 323
- Harris criterion, 228–9
- height fluctuation distributions, 143, 446
- height–height cross-correlation function, 507–8
- Hele-Shaw cells, 32, 44, 86–7, 210, 214, 269, 277, 303, 314, 340, 342–9, 357–9, 377–9, 389–91, 393, 447, 477–80, 580–2
 - radial, 346, 357, 377
- helices, 31
- heteroepitaxy, 493
- hexatic phases, 77
- hole size distribution 85, 144, 218, 226
- homogeneous functions, 4, 105
- hopping rates, 540, 541
- Horton order, 116
- HRLEED (high resolution, low energy electron diffraction), 491–2, 494
- hull generating walk, 229–30
- hull walk, 171, 229
- hulls, 170–2, 215, 220–1, 225–8, 229, 232, 236–8, 382
- human activity, 3, 150, 159
- Hurst card game, 156–8
- Hurst effect, 157, 159
- Hurst exponent, 122–59, 186, 238–40
 - measurement of, 135–59
- Huygens principle model, 552–3
- hydraulic potential, 580–2
- hydrodynamic limit, 407, 414
- hypercube stacking model, 426
- hyperscaling, 218
- ice, 357
- IGSAW (indefinitely growing self-avoiding walk), 176–7, 229
- imbibition, 386
- independent column model, 425, 527, 529
- inhomogeneous patterns, 205, 392
- instabilities, 49–50, 524, 574–84
- interface velocities, 356, 460
- intermittency, 20
- intersections, 84, 175–6
- intrinsic properties, 61
- intrinsic roughness, 142
- invasion percolation, 86–90, 214, 231–4, 344, 384, 462, 465, 478
 - destabilized, 89–90, 387
 - experiments, 86–8, 384–8
 - external perimeter, 87, 232–4
 - on fractals, 223
 - stabilized, 86–8

- trapping, 86–90, 384, 388
 - with trapping, fractal dimensionality, 227, 384, 463
- ion bombardment, 491, 510–13
- ionic mobility, 372
- Ising model, 215, 243, 382, 458, 461–2, 466
 - random field, 466
- Ivantsov model, 45, 49, 54, 574
- Kardar–Parisi–Zhang, *see* KPZ equation
- kinetic renormalization, 316
- Koch curve, 114–15
- KPZ (Kardar–Parisi–Zhang) equation, 135, 404, 407, 409, 413, 415, 417, 418, 424, 432, 435, 436, 438, 439, 447, 451, 468, 477–8, 523, 546, 561
 - anisotropic, 524, 551–2
 - exponents, 414
 - quenched, *see* QKPZ equation
- KPZ growth, 438, 499, 502, 504, 509, 516, 535–6, 550, 572
 - non-linear, 434
 - process, 559
 - universality class, 136–8, 187, 215, 421, 427, 449, 497, 504, 506, 510, 522–3, 549
 - weak coupling, 437–8
 - weakly non-linear, 437–8
- KPZ models, 430, 542
 - source of non-linearity in, 408, 424–5, 434–9, 522, 549
- Kuramoto–Sivashinsky equation, 35, 413, 414, 417–18
- labyrinthine patterns, 32–5
- lacunarity, 67, 70–4, 113, 163, 202–4, 207, 593
 - functions, 72–3, 77, 202–3
 - radial, 73–4, 77
- lamellar patterns, 25–7, 32, 434
- landscapes, 124, 152
- landslides, 159
- Langevin dynamics simulations, 271, 414, 432
- Langevin equations, 405–18, 432, 434, 439, 449–50, 512–13, 522–6, 532–3, 538, 548, 551–3, 562, 564–5
- Langmuir trough, 355
- Laplace equation, 36, 44, 49, 52–3, 190–5, 260, 263, 269, 288, 302, 306, 309, 314, 317, 321, 327, 342, 357–8, 364–5, 370, 372, 575, 581, 600
- Laplace–Beltrami operator, 410
- Laplacian field, 192
- Laplacian growth, 49, 195, 336, 365
- Laplacian growth models, 265–7, 295–6
- Laplacian needle growth, 279, 285, 565
- lattice
 - dual, 177
 - honeycomb, 177
 - path integrals, 318
 - triangular, 177
- lattice animals, 172–3, 209, 215–16
- lattice anisotropy, 275, 287
- lattice gas, 239
- law of corresponding states, 13
- layer-by-layer growth, 542
- Legendre transformation, 165, 365, 595
- Levy distribution, 129
- Levy flight ballistic deposition, 440–2
- Levy flights, 129, 174, 253, 440
- Levy walks, 129, 174, 253–4, 446
- Lichtenberg figures, 364
- lightning, 364
- linear stability analysis, 49–50
- lipid monolayers, 27, 32, 355–6
- liquid-condensed phase, 355, 356
- liquid-expanded phase, 355, 356
- local models, 53–7
- logistic map, 16–24
- long range persistence, 155–9
- loops, 85, 220, 227–8
- magma transport, 360
- magnetic field reversals, 3
- magnetic fluids, 32–4
- magnetic resonance imaging, 386
- magneto-hydrodynamic effects, 340
- manganese oxide dendrites, 327–8
- Marangoni effect, 35–7
- Marangoni instability, 313, 576
- Marangoni number, 12, 36
- Markov chain, 63, 176
- Matthew effect, 13
- maximum growth probability, 299–300, 306
- mean cluster size, 218
- mean field theories, 282–3, 302
- measure, 65–6, 70–4, 76, 82, 96–8, 161
 - harmonic, 322, 365–6, 597, 600–1
 - Hausdorff, 78
 - Lebesgue, 66, 79
 - Minkowski, 79
 - multifractal, 81, 161–5, 365, 585–607
 - support, 164
- melting, 8–9, 356

- melting (*cont.*)
 flow controlled, 358–9
- membranes, 15, 27
- microscopic solvability, 56
- minimum energy dissipation principle, 262, 317
- minimum growth probability, 322, 593, 599,
 601–3
- minimum path, 118, 209, 219, 222, 330
 dimensionality, 118, 209, 222, 330
 length distribution, 222–3
- Minkowski sausage, 79
- mobility, 40, 42, 44, 378
 ionic, 332–3, 372–3
- mode coupling theory, 414
- molecular beam epitaxy, 266, 413, 491–7, 506–7,
 521–7, 541, 545, 547, 549–50, 562
- molecular dynamics, 521
- monolayers, 27, 32, 329, 355–6
- Monte Carlo simulations, 52–3, 62, 176, 239,
 271–2, 352, 457, 546
 heat bath, 63
 Metropolis, 63, 183, 459, 545–6
- morphology
 diagram, 23, 57–8, 362, 397
 fastest growing, 24, 380
 length, 41, 47, 50, 53, 577
 transitions, 23–5, 197, 266, 331, 380, 458, 496,
 498, 518, 520, 570, 579–80
- moving boundary processes, 36–57
- mud cracking, 27–8
- Mullins–Herring equation, 409, 492–3, 530–2,
 534–5, 540–1, 544–5, 548
- Mullins–Sekerka instability, 49–51, 207, 262,
 333, 369, 381, 516–17, 574–80
- multifractal distributions, 3, 160–5, 266, 316
- multifractal geometry, 160–5
- multifractal histograms, 365, 591–6, 601
- multifractal phase transition, 270
- multifractal sets, 164
- multifractal spectrum, 165, 317
- multifractal substrates, 182, 187, 268
- multifractals, 14, 20, 92, 160–5, 360, 364,
 585–607
 left sided, 603
 mass, 606–7
- multiphase media, 214
- multiscaling, 112–13, 204–7, 316
- Navier–Stokes equation, 13, 35
- needle growth, 553
 models, 309
- network model, 384
- noise
 conserved, 410
 correlated, 439–45
 deposition 410–11, 417, 496, 525
 diffusion, 410–11, 496, 525, 541
 fast fractal Gaussian, 444–5
 fractal, 126–7
 fractional Brownian, 126
 Gaussian, 212, 405–6, 417, 442
 growth, 170, 462
 non-Gaussian, 417, 445–9, 453, 462, 453
 nucleation, 496
 quenched, 445
 spectrum, 439, 445–6, 460, 462
 unconserved, 410
 uncorrelated, 407
- noise reduction, 170, 210–11, 214, 275–6, 269,
 285–91, 347, 362, 419
 infinite, 288–90
 site selective, 362
- non-equilibrium morphology, 197
- non-linear stability analysis, 51
- non-Newtonian fluids, 345–66, 389–90
- non-Newtonian rheology, 12
- notation, 5–6, 62, 170–1, 193
- octadecyltrichlorosilane, 397–9
- off-lattice models, 138
- oil well logs, 120, 129
- olivine dendrites, 362–3
- one-sided model, 37–8, 40, 42
- optical microscopy, 336–7, 476, 509
- optimal covering, 78
- optimal path, 431
- optimization, 30
- optimization principle, 262
- Ostwald ripening, 576
- overpotential, 516
- oxidation, 518–19
- packing, 27, 246–51, 509
 models, 246–51
 periodic, 249
- paper, 478–9, 482–3
- Pareto distributions, 101
- partition functions, 108, 161–5, 301, 598, 602,
 607
- patterned ground, 22, 25
- Péclet number, 12, 26, 47–9, 52, 252, 257, 303,
 574, 577

- percolation, 69, 88, 166, 209, 214–42, 381, 463, 465
 annealed model, 382
 backbone, 218–19, 224
 continuum, 224–6
 correlation length, 146, 172, 388, 459, 479
 correlation length exponent, 146, 217, 228–9, 235–8, 459
 directed, *see* directed percolation
 experiments, 381–8
 external perimeter, 87
 frontiers, external, 236–8
 frontiers, internal, 236–8
 gradient, 226, 234–8, 479
 growth models, 229
 hole size distribution, 218–19
 hull, 177, 220–2, 224–8, 232
 invasion, *see* invasion percolation
 minimum path, 222–4
 occupation probability exponent, 217–18
 random potential, 225
 Swiss-cheese, 166, 224
 threshold, 215–16, 226, 229–30, 381, 395
 with trapping, 234
 percolation clusters, 69–70, 458
 fractal dimensionality, 215–16, 224
 spanning probability, 216
 surfaces, 220–2, 224–9, 232
 perimeter
 analysis, 144–5
 generating walk, 230
 period doubling, 19
 periodic boundary conditions, 422
 periodicity, 19
 permeability, 342–3, 357
 persistence, 155–9
 perturbations, 49–50, 86–90, 169, 575–9, 580–1
 decay of, 212, 413, 577–8
 growth of, 35
 singular, 55
 phase boundaries, 484–6
 phase separation, 27, 375–7, 398
 phospholipid layers, 355
 photosetting technology, 395
 pinning, 461, 463–4, 469, 478
 pinning strength, 452
 piping, 358
 plasma chemistry, 367
 plasma etching, 514
 plaster of Paris, dissolution, 356–8
 Poisson equation, 260–1, 303
 Poisson–Boltzmann equation, 260
 polishing, 148, 514–16
 polymer solutions, 344, 389–90
 polymers, 15–16, 32, 51, 60–1, 83, 89, 91, 173–4, 177–9, 304–5, 328–31, 338, 366, 380–1, 389–90, 434, 515–16
 polynuclear growth model, 428
 polypyrrole, 328–31
 porous films, 520, 549–51
 porous media, 36, 86–7, 232, 269, 336, 343, 356–60, 384–9, 394–7, 477–83, 520
 anisotropic, 467–8
 Potts models, 215
 power law distributions, 75, 96–104
 power law noise, 482
 power laws, 4–14
 effective, 6, 157–9
 empirical, 12–13
 homogeneous, 74
 power spectrum, 129, 147–9, 153, 238, 514–19, 565
 precipitation, 392
 prefractals, 67–70, 72, 81, 120–3
 premultifractals, 586–8
 probability density, 101
 profilometry, 148, 475–6, 515
 projection, 59, 84
 pseudo-fossils, 327–8
 pyrolytic graphite, 403
 pyroxine dendrites, 362
 QEW (quenched disorder Edwards–Wilkinson)
 equation, 451, 453–7, 465–9
 QKPZ (quenched disorder
 Kardar–Parisi–Zhang) equation, 451, 453–7, 465–9
 quasi-stationary approximation, 53
 R/S (rescaled range), 150–1, 155–9
 analysis, 150–1, 155–9
 radiography, 482
 radius of gyration, 172–3, 184, 198, 206–7, 291, 299, 343, 362, 377–9
 ramification, 395
 random crystal growth, 365
 random midpoint displacement, 127, 367
 random walkers
 blind, 182
 myopic, 181–2
 random walks, 60, 69, 71, 173–82, 190–1, 204, 601

- random walks (*cont.*)
 exact enumeration of, 181
 on fractals, 181–2, 330–1
 indefinitely growing, 176–7
 loop erased, 179
 on multifractals, 182
 return to origin, 174
 self-avoiding 89, 91, 174, 177
- rapidity, 3
- Rayleigh number, 12, 34–6
- red bonds, 215, 218, 222, 395
- relaxation, 194, 196
 conjugate gradient, 194
- renormalization, 551
- renormalization group analysis, 108, 111, 176,
 438–9, 545, 551
 functional, 176, 455
 Monte Carlo, 282, 567–8
 real-space, 316
- rescaled range, *see* R/S
- rescaling, 129, 147, 203–5, 403–7, 411, 439–40,
 526, 551
- restructuring, 421, 535
 steepest descent, 435
- Reynolds number, 12, 258, 333
- RHEED (reflection high energy electron
 diffraction), 489, 495
- rheological similarity, 12
- Rikvold model, 243
- rivers, 12, 93–4, 116–18, 150, 156, 159, 358–9
- roll patterns, 34
- roughness exponent, 132–4, 406–8
- Saffman–Taylor fingers, 210–14, 303
- Saffman–Taylor instability, 49–51, 210, 213–14,
 342, 362, 377, 389, 391, 580–4
- sapping, 358
- scale invariance, 4, 66, 99
- scale models, 12
- scale symmetry, 61, 67
- scaling, 4–13, 104–13, 215
 assumptions, 447
 collapse, *see* data collapse
 corrections to, 14, 111–12, 135, 139–40, 142,
 173, 187, 189, 365, 423, 490, 592
 large, 137
 exponents, 105
 fields, 112
 finite-size, 107–8, 112
 form, Family–Vicsek, 139, 431, 559
 forms, 2, 26, 47, 77, 88, 91, 94, 104–5, 111–13,
 131–4, 139–40, 181, 211, 203, 217–19,
 222–3, 226–8, 237–9, 256–7, 262, 273–8,
 280, 340, 343, 379, 433, 446, 460, 466–7,
 471, 473–4, 479, 487–9, 511, 532, 544,
 547–8, 565, 570–1, 592–4
 functions, 44, 77, 105, 213–14
 group, 61–2, 113
 homogeneous, 109
 inhomogeneous, 6
 multi-affine, 446
 multifractal, 14, 322
 preasymptotic, 601
 self-affine, 129, 119–59, 284, 402
 theory, classical, 9–13
 scanning tunneling microscopy, 148–9, 348, 350,
 352–4, 475–6, 486, 499, 500–5, 511–13,
 518–19, 542
 scattering, 75, 99, 215, 230, 475, 485, 486
 diffuse, 485, 488–92
 diffuse electron, 361
 electron, 361
 helium atom, 490, 505
 from self-affine fractals, 75, 486–92, 494–5,
 504–8, 515, 519
 structure function, 75, 99, 230, 488–90, 494,
 504, 511, 543–4
 Schwoebel barriers, 492, 523, 526, 541–5, 547
 Schwoebel effect, 544
 screened Coulomb interaction, 271
 screened growth model, 242–4, 289, 290, 592–4,
 599
 screening, 192, 193, 200, 212, 215, 253, 260–1,
 271, 273, 281–5, 324, 365, 371, 404, 422,
 565, 575, 599–600, 605
 electrolytes, 331, 333, 337, 369
 second order phase transitions, 109
 secondary migration, 231
 sedimentation, 420, 508
 selection principles, 23, 46, 53–6
 self-affinity, 62–71, 151
 self-similarity, 61, 66
 statistical, 69–71
 shadowing, 404, 553, 554–60, 567
 models, 493, 562–9
 shear thinning exponent, 390
 side branching, 46, 50, 54–5, 289–90, 313, 323,
 356, 380
 Sierpinski gasket, 67–9
 similarity, 9, 589

- size distributions, 58, 88, 98–100, 103–4, 216,
 217, 226–8, 273–6, 382, 448, 554, 558
- skeletons, 223
- slit island method, 143–4, 154, 476
- slush, 357–8
- Sneppen model, 463–5, 470–5
- snowflakes, 1, 22–3, 46, 360
- solid electrolytes, 336
- solidification, 25, 37–9, 42–3, 360, 574–80
 of impure materials, 39, 42–3, 579–80
- solid-on-solid models, *see* surface growth
 restricted step height, 137, 425, 437
 single-step, 135–6, 139, 144–5, 423–5, 431, 434
- sols, 215
- solubility criteria, 24, 55–6
- sparsely branched radial patterns, 392
- spherulites, 366, 380–1
- spin-flip models, 457–60
- spin-flip unconserved dynamics, 457
- spinodal decomposition, 113
- spirals, 31, 33, 67, 257–8
- sputtering, 348, 350, 367, 400, 493, 497–9, 502,
 512, 562
- stability function, 50, 579
- stability parameter, 342
- star formation, 240–1
- Stefan problems, 45, 49
- step edge dynamics, 497, 546–7
- step flow, 521, 524, 541
- step height distribution, 423, 548
- sticking probabilities, 261–9, 293, 377
 site selective, 263–9, 279, 284
- Stokes flow, 258
- Strahler order, 116
- stream function, 582
- stretched exponential distributions, 548
- subfractals, 82–3
- succinonitrile, 47–8, 361
- superdiffusive growth, 408
- superdiffusive transport, 2, 129–30
- supersaturation, 361, 574
- superuniversality, 166
- surface arrest, 468–74
- surface correlation lengths, 131
- surface currents, 408–10, 522–4, 527, 530, 532,
 535, 537, 539, 542, 545,
- surface diffusion, 266, 398, 404, 408–11, 416,
 521–45
- surface diffusion coefficients, 353, 409, 566
- surface evaporation, 564
- surface growth, 134, 401–572
- anisotropic, 551
- experiments, 475
- with non-Gaussian noise, 445–9
- with quenched disorder, 450–75
- with weak non-linearity, 434–9
- surface growth models
 continuous diffusion, 539–45
 with correlated noise, 439–45
 quenched diffusion, 527–39, 541
 solid-on-solid, 144, 424–8, 433, 464, 468, 497,
 522, 527, 530, 540
- surface height profiles, 148
- surface kinetics, 41
- surface mounds, 492, 526–7, 531, 541–2
- surface poisoning, 373
- surface roughness, 37
- surface sizes, 597–9
- surface tension, 12, 15, 39–45, 47, 51, 54–5, 266,
 269, 323, 342, 378, 581–3
- surfaces, 220, 232
 cluster, 169–72
 coarse-grained, 403
 grooved, 537, 543, 545
 island growth on, 524, 541
 rough, 130, 143
 characterization of, 135–55, 404–5
- self-affine, 186, 123–55, 272, 367
 diffuse scattering from, 485, 488–92
- self-similar, 272
- smooth, 401
- smoothing, 212, 449
- terraced, 523, 531
- vicinal, 496, 546, 551
- surface width, 132, 137–42, 402–3, 461, 463
 growth exponent, 439
 intrinsic, 142, 419
- Swift–Hohenberg equation, 35
- symmetric model, 37–8
- symmetry, 4, 55, 61, 69, 142, 412–14, 447, 523,
 525, 540, 545
 breaking, 285
 dilation, 66
 statistical, 69
- tangent rule, 554, 567
- thermal fluctuations, 271
- thermal length, 579–80
- thermal noise, 451
- thermal roughening, 543, 546
- thin films, 348–54, 375–7, 381, 398, 421, 484–5,
 491–508, 520, 541

- thin films (*cont.*)
 growth models for, 520–53
 porous, 550
 time resolved reflectivity, 484
 tip splitting, 55, 289–90, 323, 347, 356, 362, 377, 380
 mechanically induced, 334, 370
 topography, 124, 152, 510
 topological defects, 248–9, 436
 topological properties, 222
 topology, 29, 61, 320
 topothesy, 148
 transfer matrix, 112
 transformation group, 61–2, 109
 transformation matrix, 112
 transients, 137, 186, 549
 massive, 186, 204, 207–8, 211, 549
 transitions
 equilibrium roughening, 458, 494
 Hecker, 261, 368, 372–4
 insulator/conductor, 381
 multifractal phase, 270, 602–4
 transmission electron microscopy, 375, 382–3, 398–400
 transport equations, 332
 trapping, 222, 232, 384
 trees, 114, 319–22, 324, 363
 rings, 150
 topology, 116–18, 320
 ultrametric, 430
 water, 363
 turbulence, 160
- undercooling, 39, 46, 361
 universal amplitude ratios, 165, 217
 universal exponents, 217
 universality, 13, 19, 25, 109, 142, 165–6, 215–16, 383, 475
 universality classes, 13, 165–6, 258, 411–14, 435, 450, 465–9, 497, 531
 urban growth, 3, 327
- vacuum deposition, 354
 van der Drift model, 553, 572
 variation method, 149, 153–4
 varves, 150, 158
 viscosity, 342
 non-Newtonian, 389
 viscosity ratios, 34, 369, 378,
 viscous finger width, 344, 393–4, 583
 viscous fingering, 44–5, 210, 268, 327, 363, 365, 379
- Voronoi tessellation, 27–8, 177, 295
 vortex pairs, 333
- Wagner length, 262
 walking yardstick (or divider) method, 135, 152, 345
 wandering exponent, 131, 135
 wave heights, 158–9
 wavelet analysis, 141, 323–4
 wavelet transformation, 341, 324, 607
 wear, 402, 514–16
 Weibel order, 118
 Weierstrass–Mandelbrot cosine series, 128
 Weierstrass–Mandelbrot function, 2, 128
 wetting, 86–7, 231, 343, 378
 films, 44
 fronts, 433, 454
 invasion, 461, 477–83
 invasion fronts, viscous stabilization of, 480–1
- Wigner–Eckart theorem, 5
 Williams–Bjerknes model, 184–5
 wind velocity, 158
 winding number, 177–8
 Wolf–Villain model, 527–37, 540, 549
 Wood’s metal, 357, 384
 wormholing, 357
 Wulff construction, 245–6, 562
- x-ray reflectivity, 485, 504, 513
- yield stress, 393