Index

A
Absorption kinetics, 310
Additives, chemical, 72
Adiabatic venting, 105–108
Ampt-Green model, 317
Ash particles, 77–78
Asymptotic flux, 250–257
Avogadro number, 6
Avrami–Kolmogorov model, 150

B
Banach–Caccioppoli lemma, 184
Banach theorem, 265
Beavers–Joseph condition, 300
BEM. *See* Boundary element method
Beneficiation, 28
Bingham fluids, 27–34, 53, 73
Blobs, 13, 14, 17, 18
Block copolymers, 5
Blowdown process, 96–117
Boltzmann factor, 22
Bottles, 203
Boundary conditions, 92
Boundary element method (BEM), 196
Brittle-fracture point, 84
Brownian motion, 9, 22
Buried pipeline problem, 113–117

C
Cable-coating, 126
Capillarity effects, 310–331
Capillary rheometer, 128
Catalyst particles, 216
Cellular automata theory, 247
Ceramic melts, 282
Characteristics, method of, 42, 92
Chemical additives, 72
Cheng–Evans theory, 64–65
Classical flows, 132–133, 137–140
Clausius–Clapeyron equation, 155
Clip algorithm, 209, 210, 213
Coal-water slurries (CWS), 25–64
  heterogeneous, 75–79
  homogeneous, 65–69, 79–80
  pipeline flows, 63–64
  sedimentation in, 31–34, 40–61
  shearing in, 31–34
  See also specific parameters
Coalescence, 198–202
Coincidence set, 312
Colebrook–White correlation, 87
Composite materials, 277, 281
Composite velocity, 296
Compressible flows, 63
Compression molding model, 302
Condition number, 56
Connective terms, 179
Conservative flows, 84
Constitutive instability, 128
Contact radius, 199
Convection, 165, 180, 230
Coupled continuity equation, 162
Cracking, 284
Creeping flow, 73, 195

Crystallization, 230
  isobaric, 149–189
  kinetics of, 151, 156–161
  mathematical modeling of, 149
  of polymers, 149
  polypropylene, 149–189
  semicrystals, 153
Curing
  cycle, 282
  infiltration and, 290
  nonisothermal, 291–294
Curve fitting, 53–57

D
Darcy's law, 241, 243, 285, 286, 289, 297, 309
Deformability, entropy and, 11
Dedegil equation, 32
Degradation process, 27, 69–72
Diaper, analysis of, 307
Diffusion
  diffusivity, 308
  equation for, 222
  Fick's law, 222
  motion in, 15
  quasi-steady, 231
  reptation in, 15
Dilution, viscosity and, 5–10
Dimensional analysis, 14, 32, 190
Discharge process, 84
Discrete models, 125–145
Drag force, 28–30, 73, 74
Dry region, 286

E
Eckhard number, 205
Effective volume, 6
Ehrenfest equation, 155
Eigenvalue condition, 56
Einstein's formula, 6, 16
Elasticity, 12, 294
Elliptic integrals, 199
Entangled networks, 15, 19–20
Entropy, 11
Error function, 207
Espresso coffee problem, 241–280
Euler equations, 87, 117, 284, 297
Euler method, 209–211
Eulerian–Lagrangian approach, 225
Evolution equation, 136
Exit jet, 93–94
Expansion model, 223
Extrusion process, 125–145

F
Fair–Hatch formula, 320–321
Fanning friction factor, 86
FBP. *See* Free boundary problem
FEM. *See* Finite element method
Fick's law, 222
Filtration, 242
Finite element method (FEM), 30, 208, 213
Fixed point procedure, 259, 290
Flory temperature, 7
FLUENT code, 84, 100
Fokker–Planck-type equation, 230
Food packing method, 192
Ford approach, 88
Fourier's law, 225
Fourth-generation catalysts, 216
Fracture point, 84
Fragmentation font, 221
Frechet derivative, 53
Fredholm equation, 54, 55
Free boundary problem (FBP), 218, 219, 283, 309
Friction coefficients, 9, 16, 20
Friction factor, 86, 94–95
Friction, in pipes, 110–113
Froude number, 194

G
Gas bubbles, 277
Gas models, 96–97
Gel-blocking, 308, 321
Generalized solutions, 55
Glass processes, 192–207
Glassy transition temperature, 151
Godunov method, 83, 89, 91
Grain size distribution, 72

Gram matrix, 56
Granules, swelling, 307–331
Green–Ampt model, 317
Gronwall inequality, 330
Gross-melt factor, 127

H
Hatch–Fair formula, 320–321
Heat balance equation, 226
Heaviside function, 135
Herschel–Bulkley model, 65, 73
Holder space, 174, 179–181, 220, 233
Homogenization theory, 247, 300
Hydrodynamic interactions, 6, 10
Hydrophile granules, 307
Hyperbolic curing equation, 288
Hysteresis, 134

I
Impingement, 150
Inertial factors, 284–285
Infiltration, 281, 290
Injection molding, 126, 288–294, 300
Instability
  computational, 198
  constitutive, 128
  spurt and, 127–128
Insulation, 192
Intrinsic viscosity, 5–10
Inverse problems, 30
Ionic strength, 9
Irrotational flow, 197
Isentropic flow, 93

J
Jars, 203

K
Kinetic undercooling, 314–315
Kolmogorov theory, 150
Kronecker delta, 196
Kuhn segment, 7

L
Lagrangian derivatives, 166
Lagrangian displacement, 209
Latent heat release rate, 184
Lipschitz constant, 259, 265, 274
Liquid composite molding, 300
Liquid structure, 12
Localized interactions, 21–23

M
Mach numbers, 63, 83
Machnet code, 84, 94
Malkin's law, 156
Mass conservation, 210–213, 284
Maximum principle, 233, 237, 326
Melting point, 151
Melts
  extrusion and, 125–145
  plastics and, 126–128
  polymer, 7, 19–21
  screening, 7, 20
  spurt forms, 125–145
  viscosity and, 20
Mesh size, 14
Methane, 110
Molecular theory, 1–24
Moulds, 126, 203, 288–294, 300
Moving layer, 40
Multigrain model, 218, 219, 221–225

N
Navier–Stokes equation, 34, 162
  conservative form, 87
  nonlinear behavior, 29
Neck effects, 198
No flux condition, 313
No-slip condition, 125, 129–131, 207
Non-Newtonian fluids, 29, 63, 65
Nonisothermal flows, 291–294
Nonlinear equations, 91, 233, 302
Nonlinear systems, 63–124
Nonlocal boundary condition, 219
Nucleation, 150
Numerical methods, 45–50, 85, 89–92

O
Optical fibers, 192
Orifices, 94–95
Overlapping, 13
Overshoot, 142

P
Parabolic equations, 179–180, 230, 302
Parison, glass, 192, 203
Peclet number, 205
Percolation, 246–247
Permeability, 285
Perturbation methods, 85, 302
Phase change method, 150
Pigging operations, 80
Pipeline flow, 25–61, 112–114
Piston-driven flow, 133
Plateau modulus, 15, 19
Plunger, 203
Poiseuille flow, 143
Polyelectrolytes, 4, 9
Polymers
  block, 5
  coil size, 7
  cross-linking, 11
  friction coefficient, 9
  hydrodynamic interactions, 9, 10
  hydrophobic, 21
  intrinsic viscosity, 5–10
  melts, 7, 19–21, 125–145
  molecular theory of, 1–24
  network structure, 11–12
  polymerization, 215–238
  PVT diagrams, 149
  rod-like, 8–9
  temperature and, 225
  viscoelasticity, 12
  viscosizing efficiency, 8
Polypropylene, 149–189
Porosity, of bed, 42
Porous media, 307–332
Power law fluids, 29
Prandtl number, 88
Preforms, 294–299
Pressing, of glasses, 190
PVT diagrams, 149

Q
Quasi-stationary approximation, 220, 231

R
Race-tracking problems, 300
Radiation laws, 173–174
Random walk, 7
Rankine–Hugoniot relations, 85, 117
Reflection method, 74
Reflection, of shock, 96–99
Regularity problems, 230
Relaxation process, 125–145
Relaxation times, 12, 15
REOCARB technology, 64
Reptation, 15, 17
Resin transfer molding, 281
Resistivity, 251
Retarding effects, 56, 300
Reynolds numbers, 28, 30, 87, 162, 194, 286
Riemann problems, 86, 91, 96, 117
Riesz theorem, 54
Rigid preforms, 288–290
Roe's method, 86, 91
Rotating viscometer, 31–34
Rouse model, 20

S
Sand experiments, 56
Saturation, 313, 314, 315
Scaling law, 4, 14
Schauder's theorem, 259, 265, 291
Schlieren photographs, 93
Screening, in melts, 7
Sedimentation, 72, 75
  coal-water slurry and, 31–34
  column, 75
  evolution of, 34–45
  general facts, 28–31
  hindered, 73, 74, 76

pipeline, 34–45
settling rate, 32, 37, 75, 79
static, 75–78
viscosity of, 32
Seepage, 313
Self-avoiding walk (SAW), 7
Semidilute solutions
scaling law, 14
screening length, 13
solvents, 13–19
Settling. *See* Sedimentation
SGM law, 154
Shape memory, 134, 144
Sharkskin distortions, 127
Shear stress, 12, 30–34, 131–134
Shock tube problem, 85, 117
Shock waves, 85, 93, 94, 97, 99
Shooting technique, 299
Shutdown, 68–69
Sieder–Tate correlation, 88
Singular system, 55
Sink term, 228
Sintering, 190, 192, 195
viscous, 195–198
Slip model, 135, 136
Snamprogetti facilities, 25–61, 65–124
Sol-gel process, 192
Solid core model, 217–221
Solvents, semidilute, 13–19
Sorption–desorption processes, 277
Spencer–Gilmore equation, 154, 185
Spherulites, 150, 184
Spurt
distortions, 127
instability and, 127
in melts, 125–145
relaxation and, 143
viscosity and, 125, 132
zone, 134
Squeeze casting, 282
Stability conditions, 79
Stefan problem, 221, 297, 315
Sticky points, 3, 21, 23
Stokes creeping flow, 195–198
Stokes equations, 203, 300
boundary conditions, 207–208
Stokes formula, 17, 28, 32
Stokes paradox, 29
Stokes regime, 9
Stress equilibrium equation, 284
Stress-free condition, 296
Stress-strain relation, 295
Strong wave period, 87
Structure factor, 65
Swelling, 223
Switch curve, 135

T

Telechelic chains, 22
Tensor forms, 73
Thermal field analysis, 164–166
Thixotropic properties, 65, 78
Three-dimensional codes, 84
Tobin's law, 156
Traction problems, 300
Transient phases, 66
Transonic flows, 85
Trapezoidal algorithm, 210
Tube model, 16
Turbulence, 26, 84

U

Undercooling, 315
Uniqueness conditions, 331

V

Valves, 94–95, 103–104
Van der Waals forces, 7
Venting, adiabatic, 105–108
Viscoelastic properties, 300
Viscosity
effective, 30
intrinsic, 5–10
nonlinear behavior, 5
parameters of, 12
polymers and, 1–24
scaling laws, 4
sintering and, 195–198
spurt layer and, 142
zeroshear, 3

Vogel–Fulcher–Tamman relation, 204
Void ratio, 297
Voigt–Kelvin equation, 302
Volterra equations, 290
Volumetric velocity, 325–326

W
Wall effects, 73, 78, 97, 125
Warping, 186
Wetting fronts, 313, 316
White–Metzner equation, 301

Y
Yield stress, 29, 66, 73–74

Z
Zeroshear viscosity, 3
Ziegler–Natta process, 215–238