

## Index

---

- acceleration, 65, 86, 127, 143, 220  
 adaptability, 186  
 adiabatic equation, 285  
 adiabatic exponent, 276, 287, 290  
 adiabatic gas, 279  
 advancing contact angle, 391  
 $\mathcal{A}$ -equivalence, 364, 365  
 airfoil, 96  
 Airy function, 395  
 Airy stress function, 80  
 algebraic decay, 213, 299  
 ansatz, 40, 47, 300, 301, 308, 371, 372, 396, 400, 411  
 apparent contact angle, 393  
 aspect ratio, 115, 123, 220, 221, 226  
 asymptotic behavior, 17, 21, 23, 24, 26–28, 30, 31, 48, 54, 59, 100, 156–159, 161, 177, 180, 182, 201, 214, 231, 232, 237, 245, 246, 251, 327, 345, 379, 395, 396, 400–402, 405, 420  
 asymptotic expansion, 23, 156, 397  
 attractor, 298  
 autonomous dynamical system, 61  
 axisymmetric body, 70  
  
 backwards Euler scheme, 194  
 Barenblatt self-similar solutions, 59  
 beads-on-a-string configuration, 245  
 Bernoulli equation, 74, 98  
 bifurcation, 365  
 biharmonic equation, 76, 80, 105, 410, 411  
 binormal flow, 327  
 Biot–Savart law, 323, 356  
 Birkhoff–Rott equation, 331, 337  
 birth rate, 31  
  
 Blasius’ theorem, 96  
 blowup, 4, 16, 21, 31, 32, 50, 51, 55  
 Bond number  $Bo$ , 12, 138, 171, 178, 243  
 boundary integral, 174, 179  
 boundary layer, 24, 25, 48, 132, 246  
 boundary layer thickness, 24  
 breakup, 6–8, 22, 50, 51, 53, 55, 56, 123, 143–145, 147, 162, 164, 174, 177, 179, 217, 230, 231, 237, 239, 244, 249, 252, 268, 299  
 Brownian particle, 169  
 bubble, 214–216, 219, 249–252  
 bubble neck, 251  
 bubble pinch-off, 214, 249  
 Buckingham  $\Pi$ -theorem, 434, 435  
 Burgers’ equation, 259, 260, 262, 268, 272, 276  
  
 capillary length, 121, 143, 207, 403  
 capillary number  $Ca$ , 117, 133, 364, 395, 402, 404, 408, 424  
 capillary speed, 117  
 catastrophe theory, 364, 373, 375, 377  
 Cauchy–Riemann equation, 75  
 causality, 270, 271, 279, 284  
 caustic, 9, 10, 358, 373, 374, 376, 380  
 caustic line, 9, 358  
 cavity, 216–219, 221, 249, 250  
 center-manifold analysis, 209, 227, 229  
 chaos, 307  
 characteristic, 19, 63, 72, 89, 106, 117, 121, 143, 144, 147, 173, 193, 194, 196, 198, 252, 259, 260, 265, 268–271, 279, 282, 302, 375, 411  
 chemotaxis, 229

- circulation, 72, 73, 93, 96, 123, 316, 317, 319, 322
- closed orbit, 300
- coagulation, 61, 62
- coagulation kernel, 62
- codimension, 364
- compact support, 61
- complex potential, 75
- complex roots, 109
- complex velocity, 75
- complex wave field, 313, 341
- composite solution, 238
- compressibility, 13
- compressible gas, 275
- conducting liquid, 101
- conformal mapping, 94, 95, 363, 384
- conical tip, 89, 101
- conservation law, 65, 68, 279
- conservation of energy, 276, 279
- conservation of mass, 64, 120
- conservation of momentum, 65
- conserved form of slender jet equations, 129
- contact angle, 104, 111, 403, 404
- contact line, 133, 390–398, 403–405
- contact line speed, 395, 402
- continuation, 9, 50, 51, 53, 55, 230, 262, 267, 268, 284
- continuity equation, 124, 125, 249, 276, 287
- continuum, 63, 64, 412, 415
- control volume, 64, 273
- convection, 71, 160, 164, 179, 181, 319, 321
- convergence, 207
- Cooper pair, 342
- Coriolis force, 86
- corner, flow around, 89, 92, 93, 95–99, 105, 106, 108, 133, 301–303, 305–307, 327, 358
- crack length, 421
- crack motion, 421, 423
- crack tip, 80, 358–360, 390, 409–414, 416–419, 421, 422
- Crank–Nicolson scheme, 204
- crest, 98, 99
- critical deformation, 421, 423
- critical nonlinearity, 228
- critical time, 11, 252, 368
- critical value, 11, 108, 109, 252, 305, 321, 361, 371, 378, 421, 423
- crossover, 21–24, 27, 28, 50, 177
- cusp, 9, 10, 15, 80, 93–95, 358–361, 366, 371, 376, 378, 380, 382, 411, 412
- cutoff length, 392
- cycloid, 14
- cylinder, mean curvature of, 70
- cylindrical cavity, 216, 221, 226
- cylindrical shock, 285, 286, 291, 303
- dam-break problem, 295
- death rate, 31
- decay, 5, 16, 17, 20, 123, 156, 193, 195, 211, 214, 226, 325, 338, 396, 398
- deformation, 3, 77–79, 117, 118, 358, 410, 412–414, 417, 421
- deformation parameter, 117
- $\delta$ -function, 179
- density as parameter, 3, 5, 11–13, 64, 67, 71, 78, 123, 143, 146, 174, 229, 249, 259, 261, 274, 285, 313, 339, 418, 434
- density ratio, 249, 252
- diffeomorphism, 364
- diffraction pattern, 372, 378, 380, 382
- diffusion, 13
- diffusion equation, 57, 58
- dimensional analysis, 5, 7, 106, 143–145, 434
- dimensional reduction, 115
- dimensionless variable or group of variables, 7, 72, 117, 149, 154, 174, 209, 246, 297, 375, 435
- discrete scale invariance, 14
- discrete self-similarity, 109, 299, 301, 302, 307
- discretization, 190, 191
- dislocation, 313, 314
- dissipation, 392
- divergence, 104
- dominant balance, 18, 155
- double-cone profile, 174, 176
- drop pinch-off, 5, 8, 9, 13, 22, 50, 51, 69, 86, 101, 104, 115, 123, 143, 144, 146, 149, 155, 162, 164, 172, 173, 179, 180, 186, 190, 214, 215, 218, 225, 230, 240, 244–249, 268, 296, 298, 299, 390–396, 398, 402–406, 409, 423
- droplet size, 8
- dynamic viscosity, 67
- dynamical system, 40, 44, 46, 179, 181, 207, 210, 265, 298, 299, 301, 308, 317
- eigenfunction, 40–43, 210, 211
- eigensolution, 91, 106
- eigenvalue, 40–44, 47, 194, 207, 210, 211, 224, 265, 282, 298, 299, 302, 360

- eigenvalue equation, 40, 44, 47, 265  
eikonal equation, 372, 375  
elastic deformations, 80  
elastic energy, 412, 416–418, 420  
elasticity, 77, 243, 360, 414  
elasto-capillary length scale, 244  
electric jet, 101  
electrostatic potential, 99  
energy balance, 137  
energy density, 416  
energy dissipation, 68, 274, 394  
energy flux, 68, 273, 274, 390, 410, 417, 419  
energy minimizer, 343  
entropy, 270–272, 274, 275, 279, 285, 295  
entropy condition, 270, 272, 274, 279, 295  
entropy function, 275  
equilibrium points, 30  
equilibrium state, 127  
error control, 197  
error function, 85, 253  
Euler equation, 72, 250, 251, 275, 285, 303, 307  
Euler scheme, 192–195, 198  
Eulerian coordinate, 147  
evaporation, 104  
even solution, 60  
evolute, 378  
evolvent, 378  
excited state, 41  
exponential decay, 20, 21, 193, 338  
exponential growth, 31  
extensional flow, 244
- Fermat's principle, 377  
fertile and infertile individuals, 31  
finite-difference method, 189, 190  
finite-time singularity, 57  
first law of thermodynamics, 279  
fixed point, 40, 43, 44, 46, 207, 210–212, 223, 224, 298–300  
fluctuating jet equations, 169  
fluid–air interface, 3, 5  
fluid–fluid breakup, 177  
fluid jet, 123  
fluid mechanics, 313  
flux, 64, 65, 104, 117, 120, 262, 268, 274, 392  
focusing procedure, 217, 375  
force balance, 74, 127, 146, 243  
force on a fluid element, 66  
Fourier representation, 132  
Fourier series, 321
- fracture energy, 416  
free energy, 78, 343–347, 349, 352, 398  
free surface, 4, 10, 69–74, 76, 88, 97, 101, 116, 117, 124, 127, 137, 172, 179, 358–360, 366, 391, 392  
Frenet–Serret formulas, 322, 327  
Fresnel's principle, 378  
functional relation, 14
- Galilean invariance, 83  
generic mechanism, 4, 9, 30, 43, 55, 89, 93, 95, 150, 154, 177, 201, 315, 336, 339, 361, 369, 396  
geometrical optics, 289  
geometrical shock theory, 288, 289  
geometrical wave theory, 374  
germ, 364  
Ginzburg–Landau equation, 341, 352, 353  
Goursat representation, 88  
gradient dynamics, 29  
gradient flow, 343, 350, 352  
graph representation, 71  
gravity, 12, 66, 67, 69, 74, 127, 143, 145, 155, 186, 240, 392, 403  
grid, 186–190, 194, 196, 198–201  
grid point, 189, 196, 198, 199  
grid refinement, 198  
ground state, 36, 40–43, 60, 162, 207, 266
- Hagen–Poiseuille law, 84  
Hamaker constant, 398  
Hamiltonian, 317, 352  
harmonic, 79, 80, 98, 122, 348, 366, 410  
Hele–Shaw cell, 122  
Hele–Shaw flow, 122, 131, 339, 366  
Helmholtz equation, 372, 378  
Hermite polynomial, 44  
higher-order approximations, 25, 26, 93, 99, 125, 195, 214, 266, 361  
Hinge flow, 91  
homogeneous boundary conditions, 90, 91, 103, 106  
Hugoniot curve, 278, 279  
Hugoniot equation, 277  
hydraulic jump, 296  
hyperbolic growth, 18
- ideal fluid, 275  
implicit numerical scheme, 186, 195  
incompressible fluid, 65, 67, 80  
inertia, 5, 115, 121, 123, 143–146, 154, 174, 177, 201, 217, 243, 249

- infertile individuals, 31  
 inhomogeneous boundary conditions, 91  
 inner product, 210–212, 368  
 inner solution, 24–26, 272, 415  
 insects, fertile and infertile, 31  
 integral equation, 219  
 integro-differential equation, 61  
 interaction energy, 346, 349  
 interface, 3, 5, 69–71, 74, 117, 120, 173, 174,  
 179, 180, 207, 218, 220, 340, 395, 398  
 internal energy, 276  
 invariant manifold, 211  
 inviscid breakup, 7, 144, 172, 174  
 inviscid fluid, 172, 316, 352  
 inviscid pinch-off, 146  
 involutes, 378  
 Irwin relationship, 420  
 isotropic fluid, 67
- J*-integral, 410, 419, 421–423  
 jet, 8–10, 63, 101, 123, 126, 127, 144, 162,  
 163, 169, 231, 240–242, 245, 248  
 Johnson–Segalman model, 242, 245, 255  
 Joukowski transformation, 94  
 Joukowski wing, 93  
 jump condition, 262, 267, 269, 272, 307
- Kaden spiral, 357  
 Keller–Segel model, 229  
 Kelvin–Helmholtz instability, 333  
 Kelvin’s theorem, 73, 316, 323  
 kinematic boundary condition, 127, 173  
 kinematic viscosity, 13, 123, 240  
 kinetic energy, 29, 67, 92, 170  
 Kirchhoff vortex, 356  
 Kirchhoff’s formula, 358  
 Kutta condition, 96
- Lagrange singularities, 377  
 Lagrangian, 147, 149, 151, 159, 241, 242, 331  
 Lagrangian coordinates, 147  
 Lagrangian derivative, 66  
 Lagrangian transformation, 241  
 Lamé constants, 78  
 Langevin equation, 170  
 Laplace’s equation, 73, 74, 89, 92, 103, 174,  
 219  
 large-scale behavior, 7, 23, 200, 358, 390, 410  
 leading-order approximation, 25, 26, 46, 47,  
 49, 89, 92, 96, 101, 118–120, 158, 195,  
 211, 217, 218, 224, 225, 229, 237, 244,  
 247, 323, 325, 334, 361, 372, 376, 397,  
 400–402  
 left–right equivalence, 364  
 Legendre function, 100  
 Legendre singularities, 377  
 length scale, 4–7, 10, 72, 89, 102, 118, 123,  
 124, 145–147, 149, 152, 172, 176, 177,  
 200, 201, 244, 252, 313, 392, 394, 397,  
 398, 402  
 leveling of thin film, 120  
 lift force, 93  
 limit cycle, 298, 302  
 line vortex, 313, 316, 322  
 linear fit, 201  
 linear stability, 138  
 linearization, 224  
 liquid film, 398  
 liquid jet, 63  
 local singular expansion, 89  
 local singular solution, 421  
 logarithmic behavior, 39, 100, 106, 181, 199,  
 213, 214, 217, 220, 299, 308, 332, 345,  
 346, 367, 394, 396, 406, 408  
 logarithmic singularity, 100, 122  
 logarithmic time, 308  
 logistic equation, 31  
 long-time evolution, 57  
 longitudinal wave, 88  
 loop of integration, 73, 315, 316, 329–331,  
 344  
 Löwner–Kufarev equation, 384  
 lubrication approximation, 172  
 lubrication equation, 133  
 lubrication limit, 131, 391, 423
- Mach number, 289, 303, 305, 306, 374  
 Mach stem, 303  
 Malthus growth, 31  
 map, 364  
 mass conservation, 57  
 mass flux, 64  
 matched asymptotic expansion, 23, 28  
 matched asymptotics, 29  
 matching, 21, 23–25, 35, 36, 46, 47, 49, 56,  
 156, 164, 209, 210, 220, 230, 231, 245,  
 267, 272, 301, 326, 328, 390, 394, 396,  
 402, 404, 410  
 matching condition, 24, 35, 56, 156, 210, 220,  
 230, 264, 267, 272, 287, 301, 326, 396,  
 397

- mean curvature, 69, 70, 120, 127, 139, 207, 208, 210, 220, 224  
 mean curvature flow, 207, 210, 224  
 microscopic description, 63, 67, 390, 392, 394–398, 410, 412, 415, 421  
 miniversal unfolding, 365  
 mixed boundary conditions, 102  
 Mode I, 412  
 Mode II, 412  
 Mode III, 414  
 Moffatt eddies, 105, 107  
 momentum, 64, 65, 67, 170, 252, 276  
 momentum flux, 65  
 Moore’s singularity, 335, 338, 339  
 mortality, 59  
 moving contact line, 410, 416  
 moving front, 61  
 moving singularity, 391
- Navier–Stokes equation, 3, 13, 67, 72, 76, 86, 123, 125, 126, 176  
 neck, 8, 9, 152, 162, 164, 172, 214, 251, 252  
 Newton’s law, 65  
 Newton’s method, 197  
 no-slip condition, 105, 116, 117, 130, 391  
 noise, 169, 170  
 nondimensionalization of variables, 125  
 non-generic case, 32, 55  
 non-invertibility, 368  
 non-invertible mapping, 336, 363  
 nonlinear instability, 164  
 nonlinear Schrödinger equation, 228, 352, 353  
 nonlinear wave, 302  
 nonlinearity, 4, 7, 11, 16, 18, 22, 45, 76, 117, 151, 164, 194, 195, 197, 207, 211, 212, 224, 259, 289, 299, 313, 337, 372, 373, 401  
 non-local effect, 149  
 non-Newtonian fluid, 136  
 non-uniqueness, 272  
 normal force, 70, 74  
 normal stress, 173, 218, 240, 359  
 numerical method, 186
- odd solution, 60  
 Ohnesorge number  $Oh$ , 12, 128, 138, 171, 187, 243  
 opening angle, 90, 95, 97, 98, 100–102, 107, 358  
 optical caustic, 372  
 optimal approximation, 58
- order parameter, 342, 343  
 ordinary differential equation, 16  
 outer solution, 24, 25, 36, 47, 49, 231, 272, 396, 398, 404
- partial differential equation, 3, 63, 117, 313  
 Pearcey’s function, 382  
 perturbation theory, 25  
 phase plane analysis, 61  
 phase singularity, 315  
 pinch-off, 5, 9, 59, 123, 127, 143, 144, 155, 158, 162, 174, 176, 198, 200, 214, 215, 225, 239, 249, 298  
 plane Poiseuille flow, 76  
 plasma, 296  
 point source, 65  
 point vortex, 316  
 Poiseuille flow, 84  
 Poisson’s ratio, 78  
 Polubarinova–Gal’in equation, 368, 384  
 polymer, 63, 240, 241, 243, 245  
 population, 31  
 porous medium, 59  
 porous medium equation, 61  
 post-breakup solution, 230, 239, 243  
 potential energy, 417  
 potential flow, 72, 73, 89, 93, 96, 122  
 power law, 28, 362  
 power law behavior, 136, 299, 423  
 pre-breakup solution, 230, 231  
 precursor film, 393, 394, 398–400, 416  
 pressure, 3, 66, 67, 69, 73, 74, 76, 98, 101, 118–120, 122, 124–126, 155, 188, 190, 216–219, 249–252, 279, 285–287, 359, 366, 367, 398  
 pressure gradient, 76, 119  
 pressure jump, 69, 218  
 pressure scale, 118  
 probability, 62  
 propagation, 10  
 propeller, 12
- quadratic nonlinearity, 211, 224  
 quasistatic motion, 78, 416, 421
- radius of curvature, 4, 10, 324, 374, 379, 394  
 Rankine–Hugoniot conditions, 262, 277, 282, 284, 295  
 rarefaction wave, 271, 284, 296  
 rate-of-deformation tensor, 66, 77  
 rate of energy dissipation, 68, 274  
 ray, 289, 290, 305, 373, 374, 378, 382

- Rayleigh–Plateau instability, 128, 165, 166  
 Rayleigh wave, 88  
 Rayleigh wavelength, 129  
 reaction–diffusion equation, 34  
 receding neck, 237  
 receding thread, 56, 231, 238, 239  
 regularity, 29  
 regularity condition, 36, 46, 149, 159  
 regularization, 50, 272, 339  
 relaxation time, 240, 245  
 renormalization transformation, 308  
 renormalized energy, 346, 347  
 rescaled equation on variables, 19, 33, 119,  
 126, 173, 174, 180, 308  
 residuals, 197  
 resources, limited, 31  
 Reynolds’ equation, 131  
 Reynolds number  $Re$ , 12, 13, 72, 76, 105, 110,  
 176, 184, 252, 319  
 Ricci flow, 227  
 Richardson extrapolation, 195  
 Richardson law, 13
- saddle-node bifurcation, 30  
 Saffman–Taylor finger, 384  
 satellite bubble, 249, 252  
 satellite drop, 8, 249  
 saturation, 22–24, 26  
 scale invariance, 19, 27, 396, 397  
 scaling, 5–7, 24, 27, 36, 49, 90, 92, 99, 100,  
 106, 143, 145–147, 154, 172, 174, 175,  
 201, 214, 215, 217, 226, 231, 249, 251,  
 264, 265, 287, 299, 301, 313, 326, 337,  
 361, 371, 394, 397, 409, 435  
 scaling exponent, 5–7, 36, 90, 92, 99, 100,  
 102, 106, 145–147, 175, 214, 217, 249,  
 251, 287, 301  
 second law of thermodynamics, 279  
 self-energy, 346, 347  
 self-induction approximation, 325  
 self-similar solution, 61, 164, 357  
 self-similarity, 6, 7, 34, 106, 145, 146, 174,  
 264, 265  
 self-similarity, type-I, 299  
 self-similarity, type-II, 213, 299  
 self-similarity of the first kind, 6, 34, 91, 145  
 self-similarity of the second kind, 7, 34, 37,  
 91, 100, 103, 106, 146, 147, 175, 264,  
 265, 286  
 shallow-water system, 137  
 shear, 66, 76, 136, 329, 335, 359, 395, 414  
 shear flow, 66  
 shear force, 12  
 shear rate, 66  
 shear stress, 391  
 shock, 11, 261–271, 273–277, 279, 281,  
 284–287, 289–291, 295–297, 302, 303,  
 305, 306, 313  
 shock front, 289, 302, 305  
 shock-shock, 303  
 shock waves, 259  
 shooting method, 161, 232, 401  
 similarity ansatz, 286  
 similarity equation, 34, 40, 55, 56, 136, 155,  
 209, 210, 236, 264, 273, 399  
 similarity form, 220  
 similarity function, 221  
 similarity solution, 33, 36, 39, 42, 43, 45, 46,  
 48, 55–57, 59–61, 150, 151, 156, 157,  
 176, 177, 179, 180, 207, 209, 230, 265,  
 266, 300, 346, 395, 396, 399, 402  
 similarity variables, 42, 150, 152, 160, 172,  
 180, 231, 371  
 simulation, 63, 172, 174, 176, 194, 196,  
 198–201, 243, 244, 251, 302, 307  
 singularity theory, 364  
 singularity time, 28  
 sink, 218, 219, 366, 383  
 slender body theory, 218  
 slender jet, 8, 115, 127, 144, 218, 219, 226,  
 230, 231, 249  
 slenderness parameter, 152  
 slice of fluid, 129  
 slip length, 111, 130, 399  
 slow decay, 214  
 slow dynamics, 207, 211–214  
 small-scale behavior, 23, 198, 303, 390  
 Smoluchowski equation, 61  
 soap bubble, 174  
 sonic point, 159, 160  
 sound speed, 286, 289  
 source, 216, 367, 378  
 space curves, 366  
 sphere, 70  
 spherical cap, 393  
 spherical cavity, 217  
 spherical shock, 285, 286  
 spike, limiting shape of cone, 101  
 spiral, 331, 332, 357  
 spreading, 59, 115, 135, 392, 394, 409, 423

- stability, 39, 40, 42, 44, 68, 157, 164, 174,  
     191, 193, 195, 200, 239, 301, 302, 321,  
     333, 334, 356  
 stability of numerical scheme, 186  
 stable fixed point, 47  
 stable solution, 162  
 stagnation point, 166  
 steady stream, 138  
 Stokes' equation, 79  
 Stokes flow, 174  
 Stokes' paradox, 185  
 Stokes' theorem, 73, 316  
 Stokes wave, 97  
 Stokeslet, 179  
 strain tensor, 77  
 strange attractor, 299  
 stream function, 75, 76, 93, 105, 109, 316,  
     356, 360  
 streamline, 75, 106, 360  
 strength of a shock, 273  
 stress balance, 174  
 stress intensity factor, 412, 420  
 stress tensor, 66, 78, 116, 411  
 stress-free crack faces, 411  
 stretched coordinate, 132  
 stretching, 164  
 strong shock, 278, 285, 290  
 structure function, 29  
 subdominant balance, 155  
 summation convention, 65  
 surface area, 129  
 surface element, 66, 69  
 surface energy, 129, 392, 393  
 surface tension, 5, 10, 12, 69, 97, 98, 101, 102,  
     117, 118, 125, 143, 144, 154, 179, 201,  
     215–217, 243, 246, 339, 341, 395, 416  
 swallowtail, 365, 366, 375, 376  
  
 tangential force, 70, 74  
 Tanner's law, 394, 409, 423  
 Taylor scraper, 105, 106, 110, 131  
 thin film, 115, 120, 123, 394, 395, 398  
 thin film equation, 132, 136, 394, 395, 398  
 thin film limit, 134  
 thread, 51, 53, 54, 56, 146, 151, 159, 162–164,  
     180, 194, 218, 239, 240, 243, 244,  
     246–248, 435  
 three-phase contact line, 390  
 time scale, 19, 23, 123, 124, 154, 186, 193,  
     194, 196, 209, 240, 248, 326, 351  
  
 tip, 4, 56, 80, 91, 97, 99–102, 230, 231, 236,  
     237, 360, 376, 409, 410, 416, 417  
 tip of a crack, 410, 412, 416–419, 421  
 tip singularity, 97, 360, 390  
 topological defect, 315  
 topological degree, 344  
 topological singularity, 315  
 trailing edge, 15, 93, 95, 96  
 transverse average, 122  
 transverse wave, 88  
 traveling wave, 78, 88, 97, 98, 178, 179, 181,  
     182, 272–274, 297, 299, 395  
 turbulence, 13  
 turbulent motion, 29  
 type-II superconductor, 313  
  
 unconditionally stable scheme, 195  
 unfolding, 364  
 unfolding parameter, 364  
 uniqueness, 4, 29  
 universal structure, 3–5, 7–9, 17, 19, 64–66,  
     68–72, 74–76, 83, 86, 88–90, 92, 93, 95,  
     96, 98, 105, 106, 115, 117, 119–122, 124,  
     125, 127, 134, 137, 149, 154, 163, 164,  
     169, 174, 177, 179–181, 187, 190, 191,  
     216, 218, 219, 244, 246, 248, 249,  
     259–261, 264, 270–272, 275, 277, 281,  
     284, 285, 296, 297, 299, 313, 316, 319,  
     321–323, 325, 328–331, 337, 339, 341,  
     350, 352, 354, 356–361, 367, 371, 375,  
     376, 390–392, 394, 410, 412, 434  
 unstable solution, 37, 42, 43, 266  
  
 van der Waals interaction, 398  
 vanishing viscosity, 272, 275, 279  
 variational formulation, 137  
 velocity scale, 72, 105, 117, 173  
 viscoelastic material, 239  
 viscosity, 5, 12, 13, 66, 67, 72, 74, 76, 117,  
     134, 136, 143–145, 147, 154, 177, 179,  
     201, 217, 218, 273, 333, 338, 392, 400  
 viscosity ratio, 178  
 viscous breakup, 144, 147  
 viscous Burgers' equation, 273  
 viscous dissipation, 392  
 viscous flow in corner, 105  
 viscous fluid, 10, 66, 105, 117, 149, 153, 177,  
     217, 218, 359, 366  
 viscous fluid sheet, 136  
 viscous scale, 143  
 viscous similarity solution, 177

- Voinov solution, 398, 410  
volume conservation, 117, 252  
von Kármán vortex street, 319  
vortex, 313–317, 319, 321–323, 325, 327–331,  
333, 335, 338, 340, 344–351, 353, 354,  
356, 357  
vortex core, 315, 344  
vortex filament, 322, 323, 327, 328  
vortex interaction, 313, 349, 350, 352  
vortex patch, 356  
vortex sheet, 328–331, 335, 338, 340, 357  
vorticity, 72, 73, 316, 319, 322, 323, 325, 328,  
331, 356, 357  
waiting time phenomenon, 61  
wave crest, 98  
wave equation, 11, 78, 88, 259, 289, 372  
wave front, 10, 372, 374, 375, 377, 379, 380  
wave packet, 166  
Weber number  $We$ , 12, 138, 341, 342  
wedge, 89, 91, 98, 392  
Weierstrass function, 14  
wing, 15, 93, 95, 96, 99, 122, 123  
WKB method, 158, 165, 400  
Young's modulus, 78  
Zimm's constant, 240