

---

# Index

- acoustic speed, 310, 425
- balance laws, 2
- Boltzmann equation, 334, 423
- boundary layer, 374, 380, 423
- Burgers equation, 24, 71, 151, 293
- C-F-L condition, 208, 272, 381
- cancellation of waves, 29, 186, 212
- Chapman-Enskog expansion, 319, 343
- characteristic curve, 5, 149
- characteristics, method of, 5–7, 150, 399–401
- conservation laws
  - hyperbolic, 2, 5, 123
  - viscous, 71, 103, 279
- constitutive relation, 4, 138, 340
- contact discontinuity, 162
- delta function, 11–12, 50, 72, 308–311
- development of singularity, 7, 136, 415
- diffusion waves, 72, 81, 293
- Duhamel’s principle, 77, 87, 291, 300
- elasticity, 175, 327
- energy estimate, 59, 77, 113, 128, 133, 285, 311
- entropy condition
  - Lax, 159
  - Liu, 170
  - Oleinik, 105
- entropy pair, 57, 113, 126, 139, 313, 339
- equi-distributed sequences, 210
- equilibrium, 318, 339
- Euler equations in gas dynamics
  - Eulerian and Lagrangian
    - coordinates, 136–138
  - full, 4, 136, 192, 338
  - isentropic, 164, 183
  - potential flow, 393–395
- existence theory
  - scalar laws, 31, 35–38, 80, 120
  - systems, 132, 230, 315
- Fourier transform, 308
- front tracking, 274
- generalized characteristics, 40, 243
- generalized entropy functional, 59–68, 237
- generalized Riemann problem, 325, 353

- genuinely nonlinear, 151  
 Glimm functional, 213–214  
 Glimm scheme, xiv  
 Green's function, 72, 86, 310, 315
- heat equation, 71, 294, 310  
 Hilbert expansion, 320, 346  
 Hopf equation, 24, 151  
 Hopf-Cole transformation, 78, 84  
 Hugoniot curve, 152  
 hyperbolic, 2, 5, 124, 147,  
     395–396
- initial layer, 83, 306, 310, 424  
 interaction measure, 109,  
     111–113, 200, 212–213,  
     216–218  
 irreversible, 25, 27, 74, 338
- kinetic theory, 329, 334, 423
- $L_1$  stability theory, 32, 119, 233,  
     276  
 $L_2$  stability theory, 69, 133
- large-time behavior  
   hyperbolic conservation laws,  
     249–254, 260–272  
   scalar laws, 45–59, 94–100,  
     111–113  
   viscous conservation laws,  
     280–301  
   with boundary, 376–379, 410
- Lax entropy condition, 159  
 linearly degenerate, 158  
 Liu entropy condition, 170  
 Liu-Yang functional, *see also*  
   generalized entropy  
   functional
- magnetohydrodynamics, 176, 302,  
     362  
 metastable, 98
- $N$ -wave, 50, 68, 99, 267
- Navier-Stokes equations, 301,  
     320, 333, 344, 421  
 nozzle flows, 351  
 numerical schemes, 207, 272, 380
- Oleinik entropy condition, 105
- $p$ -system, 153, 302
- polyatomic gases, 164–165,  
     192–194
- porous media equation, 101, 371
- potential flows, *see also* Euler  
   equations in gas dynamics  
 propagation of discontinuity, 11,  
     305, 360
- quasilinear, 7, 305
- Rankine-Hugoniot condition, 10,  
     142, 152, 322, 403
- rarefaction wave, 14, 83, 152, 346
- regularity of solutions, 42, 254,  
     275
- relaxation, 317
- resonance, 349
- Riemann invariants, 168, 187
- Riemann problem, 22, 106, 159,  
     170, 325, 424
- second law of thermodynamics,  
     139, 302, 339, 341
- self-similar, 22, 73, 395
- semilinear, 7
- shallow water wave, 327
- shock polar, 403
- shock profiles, 82, 103, 303, 323,  
     342, 366, 382
- shock wave, *see also*  
   Rankine-Hugoniot condition
- simple wave, 149, 399
- small divisor, 384
- sound speed, *see also* acoustic  
   speed

- stability of waves, *see also*  
  large-time behavior  
  diffusion waves, 54, 98, 260,  
    281, 300  
  rarefaction waves, 47, 289–292  
  shock waves, 45, 284–286, 419  
sub-characteristic condition, 319,  
  333  
sub-shocks, 357  
symmetric systems, 126–128  
  
thermal equilibrium, 330, 340  
thermal wave, 392  
  
uniqueness, 16, 37–38, 275,  
  421–423  
  
vacuum, 165, 368, 385, 425  
variation, 41, 68, 205  
viscosity matrix, 279–280, 302,  
  345–346  
  
vortex sheet, 391  
  
wave coupling, 373–380  
wave curves, 160–161, 171  
wave interactions  
  Euler equations, 183–194  
  hyperbolic conservation laws,  
    194–201  
  multi-dimensional Euler  
    equations, 407–413  
  scalar laws, 27–31, 109  
  viscous conservation laws,  
    292–301  
wave tracing, 218  
weak solutions, 9, 118, 119, 306,  
  421  
well-posedness theory, 32, 120,  
  205, 421  
  
zero dissipation limit, 71, 276, 424  
zero mean free path, 424

SELECTED PUBLISHED TITLES IN THIS SERIES

- 215 **Tai-Ping Liu**, *Shock Waves*, 2021
- 214 **Ioannis Karatzas and Constantinos Kardaras**, *Portfolio Theory and Arbitrage*, 2021
- 211 **Mateusz Michałek and Bernd Sturmfels**, *Invitation to Nonlinear Algebra*, 2021
- 210 **Bruce E. Sagan**, *Combinatorics: The Art of Counting*, 2020
- 209 **Jessica S. Purcell**, *Hyperbolic Knot Theory*, 2020
- 208 **Vicente Muñoz, Ángel González-Prieto, and Juan Ángel Rojo**, *Geometry and Topology of Manifolds*, 2020
- 207 **Dmitry N. Kozlov**, *Organized Collapse: An Introduction to Discrete Morse Theory*, 2020
- 206 **Ben Andrews, Bennett Chow, Christine Guenther, and Mat Langford**, *Extrinsic Geometric Flows*, 2020
- 205 **Mikhail Shubin**, *Invitation to Partial Differential Equations*, 2020
- 204 **Sarah J. Witherspoon**, *Hochschild Cohomology for Algebras*, 2019
- 203 **Dimitris Koukoulopoulos**, *The Distribution of Prime Numbers*, 2019
- 202 **Michael E. Taylor**, *Introduction to Complex Analysis*, 2019
- 201 **Dan A. Lee**, *Geometric Relativity*, 2019
- 200 **Semyon Dyatlov and Maciej Zworski**, *Mathematical Theory of Scattering Resonances*, 2019
- 199 **Weinan E, Tiejun Li, and Eric Vanden-Eijnden**, *Applied Stochastic Analysis*, 2019
- 198 **Robert L. Benedetto**, *Dynamics in One Non-Archimedean Variable*, 2019
- 197 **Walter Craig**, *A Course on Partial Differential Equations*, 2018
- 196 **Martin Stynes and David Stynes**, *Convection-Diffusion Problems*, 2018
- 195 **Matthias Beck and Raman Sanyal**, *Combinatorial Reciprocity Theorems*, 2018
- 194 **Seth Sullivant**, *Algebraic Statistics*, 2018
- 193 **Martin Lorenz**, *A Tour of Representation Theory*, 2018
- 192 **Tai-Peng Tsai**, *Lectures on Navier-Stokes Equations*, 2018
- 191 **Theo Bühler and Dietmar A. Salamon**, *Functional Analysis*, 2018
- 190 **Xiang-dong Hou**, *Lectures on Finite Fields*, 2018
- 189 **I. Martin Isaacs**, *Characters of Solvable Groups*, 2018
- 188 **Steven Dale Cutkosky**, *Introduction to Algebraic Geometry*, 2018
- 187 **John Douglas Moore**, *Introduction to Global Analysis*, 2017
- 186 **Bjorn Poonen**, *Rational Points on Varieties*, 2017
- 185 **Douglas J. LaFountain and William W. Menasco**, *Braid Foliations in Low-Dimensional Topology*, 2017
- 184 **Harm Derksen and Jerzy Weyman**, *An Introduction to Quiver Representations*, 2017
- 183 **Timothy J. Ford**, *Separable Algebras*, 2017
- 182 **Guido Schneider and Hannes Uecker**, *Nonlinear PDEs*, 2017
- 181 **Giovanni Leoni**, *A First Course in Sobolev Spaces, Second Edition*, 2017
- 180 **Joseph J. Rotman**, *Advanced Modern Algebra: Third Edition, Part 2*, 2017
- 179 **Henri Cohen and Fredrik Strömberg**, *Modular Forms*, 2017
- 178 **Jeanne N. Clelland**, *From Frenet to Cartan: The Method of Moving Frames*, 2017
- 177 **Jacques Sauloy**, *Differential Galois Theory through Riemann-Hilbert Correspondence*, 2016
- 176 **Adam Clay and Dale Rolfsen**, *Ordered Groups and Topology*, 2016
- 175 **Thomas A. Ivey and Joseph M. Landsberg**, *Cartan for Beginners: Differential Geometry via Moving Frames and Exterior Differential Systems, Second Edition*, 2016

For a complete list of titles in this series, visit the  
AMS Bookstore at [www.ams.org/bookstore/gsmseries/](http://www.ams.org/bookstore/gsmseries/).