

Contents

Preface	v
Introduction	1
1. Definitions and examples	1
2. Weak solutions of systems of conservation laws	11
3. Entropy solutions	21
Notes	35
I. Nonlinear hyperbolic systems in one space dimension	37
1. Linear hyperbolic systems with constant coefficients	37
2. The nonlinear case. Definitions and examples	40
3. Simple waves and Riemann invariants	49
4. Shock waves and contact discontinuities	60
5. Characteristic curves and entropy conditions	70
6. Solution of the Riemann problem	83
7. The Riemann problem for the p -system	87
Notes	97
II. Gas dynamics and reacting flows	99
1. Preliminaries	99
2. Entropy satisfying shock conditions	108
3. Solution of the Riemann problem	126
4. Reacting flows. The Chapman–Jouguet theory	142
5. Reacting flows. The Z.N.D. model for detonations	160
Notes	166
III. Finite difference schemes for one-dimensional systems	167
1. Generalities on finite difference methods for systems	167
2. Godunov’s method	182

3. Roe's method	196
4. The Osher scheme	229
5. Flux vector splitting methods	237
6. Van Leer's second-order method	245
7. Kinetic schemes for the Euler equations	269
Notes	301
IV. The case of multidimensional systems	303
1. Generalities on multidimensional hyperbolic systems	303
2. The gas dynamics equations in two space dimensions	316
3. Multidimensional finite difference schemes	343
4. Finite-volume methods	360
5. Second-order finite-volume schemes	403
Notes	415
V. An introduction to boundary conditions	417
1. The initial boundary value problem in the linear case	417
2. The nonlinear approach	435
3. Gas dynamics	442
4. Absorbing boundary conditions	446
5. Numerical treatment	453
Notes	460
Bibliography	461
References	461
Index	501