

CONTENTS

PART I NUMERICAL METHODS

Chapter 1 Numerical Methods for Initial–Boundary–Value Problems for First Order Quasilinear Hyperbolic Systems in Two Independent Variables

| | |
|---|-----|
| Introduction | 2 |
| § 1 Formulation of Problems..... | 3 |
| § 2 Four Model Problems | 7 |
| § 3 Some Difference Schemes | 18 |
| § 4 The Stability of Difference Schemes for Initial–Boundary–Value Problems and the “Condition” of Systems of Difference Equations | 40 |
| § 5 Solution of Systems of Difference Equations | 88 |
| § 6 The Stability of the Procedure of Elimination and the Procedure of Calculation of the Unknowns, and the Convergence of Iteration | 99 |
| Appendix 1 Stability of Difference Schemes for Pure–Initial–Value Problems with Variable Coefficients | 111 |
| Appendix 2 A Block–Double–Sweep Method for “Incomplete” Linear Algebraic Systems and Its Stability | 124 |
| Appendix 3 Stability and Convergence of Difference Schemes for Linear Initial–Boundary–Value Problems | 160 |

Chapter 2 Numerical Methods for a Certain Class of Initial– Boundary–Value Problems for the First Order Quasilinear Hyperbolic Systems in Three Independent Variables

| | |
|----------------------------------|-----|
| Introduction | 171 |
| § 1 Formulation of Problems..... | 171 |
| § 2 Numerical Methods | 176 |

Chapter 3 Numerical Schemes for Certain Boundary–Value Problems of Mixed–Type and Elliptical Equations

| | |
|---|-----|
| § 1 Formulation of Problems..... | 194 |
| § 2 Numerical Schemes | 197 |
| § 3 Iteration Methods..... | 199 |
| § 4 Interpolation Polynomials | 202 |
| § 5 Remarks on Improperly Posed Problems..... | 204 |

PART II INVISCID SUPERSONIC FLOW AROUND BODIES

| | |
|-------------------------------|-----|
| Introduction to Part II | 210 |
| § 1 Outline of Part II..... | 210 |
| § 2 Literature Review | 212 |

Chapter 4 Inviscid Steady Flow

| | |
|---|-----|
| § 1 The System of Fundamental Differential Equations and Its Characteristics..... | 235 |
| § 2 Discontinuities, Singularities, and the Intersection and Reflection of Strong Discontinuities | 265 |
| § 3 Boundary Conditions and Internal Boundary Conditions | 301 |
| § 4 Calculation of Thermodynamic Properties of Equilibrium Air | 311 |
| § 5 A Non-equilibrium Model of Air | 326 |

Chapter 5 Calculation of Supersonic Flow around Blunt Bodies

| | |
|---|-----|
| § 1 Introduction | 337 |
| § 2 Formulation of Problems | 338 |
| § 3 Methods of Solution | 342 |
| § 4 Calculation of the Axisymmetric Flow | 346 |
| § 5 Calculation of the Three-dimensional Flow | 353 |
| § 6 Results..... | 364 |
| Appendix Application of the Method of Lines to Supersonic Regions of Flow | 388 |

Chapter 6 Calculation of Supersonic Conical Flow

| | |
|----------------------------------|-----|
| § 1 Introduction | 395 |
| § 2 Formulation of Problems..... | 396 |
| § 3 Methods of Solution | 399 |
| § 4 Results..... | 404 |

Chapter 7 Solution of Supersonic Regions of Flow around Combined Bodies

| | |
|---|-----|
| § 1 Introduction | 423 |
| § 2 Formulation of Problems..... | 425 |
| § 3 Numerical Methods | 441 |
| § 4 Computed Results | 468 |
| Appendix A Numerical Method with High Accuracy for Calculating the Interactions between Discontinuities in Three Independent Variables..... | 563 |

| | |
|--|-----|
| References | 573 |
| General References | 573 |
| Special References A: Numerical Calculation of Flow in Subsonic and Transonic Regions..... | 578 |
| Special References B: Numerical Calculation of Conical Flow | 589 |
| Special References C: Numerical Calculation of Flow in Supersonic Regions..... | 592 |
| Subject Index | 597 |