

Contents

| | |
|--------------------|----|
| CONTRIBUTORS | ix |
| PREFACE | xi |

NUMERICAL MAGNETOHYDRODYNAMICS FOR HIGH-BETA PLASMAS

Jeremiah U. Brackbill

| | |
|--|----|
| I. Introduction | 1 |
| II. Numerical Methods..... | 3 |
| III. The Computation of Convective Transport | 10 |
| IV. A Generalized Mesh Method for MHD | 17 |
| V. Applications | 29 |
| VI. Conclusions | 38 |
| Appendix | 38 |
| References..... | 39 |

WATERBAG METHODS IN MAGNETOHYDRODYNAMICS

David Potter

| | |
|--|----|
| I. The Waterbag Concept | 43 |
| II. Equilibrium Properties of One Waterbag | 49 |
| III. Equilibria of Current Distributions | 60 |
| IV. Adiabatic Constraints | 69 |
| V. Further Applications | 76 |
| References | 82 |

SOLUTION OF CONTINUITY EQUATIONS BY THE METHOD OF FLUX-CORRECTED TRANSPORT

J. P. Boris and D. L. Book

| | |
|--|-----|
| I. Introduction | 85 |
| II. Elements of FCT Algorithms | 93 |
| III. Optimization of FCT Algorithms | 105 |
| IV. Applications of Flux-Corrected Transport | 115 |
| References..... | 128 |

MULTIFLUID TOKAMAK TRANSPORT MODELS

John T. Hogan

| | |
|---|-----|
| I. General Remarks | 131 |
| II. Plasma Models | 142 |
| III. Suprathermal Plasma: Injected Ions and Alpha Particles | 150 |
| VI. Neutral Gas | 153 |
| V. Impurities | 158 |
| VI. Summary | 161 |
| References | 162 |
| Appendix: Bibliography | 164 |

ICARUS—A ONE-DIMENSIONAL PLASMA DIFFUSION CODE

M. L. Watkins, M. H. Hughes, K. V. Roberts, P. M. Keeping, and J. Killeen

| | |
|----------------------------------|-----|
| I. Introduction | 166 |
| II. The Physical Model | 169 |
| III. The Numerical Model | 176 |
| IV. Programming Techniques | 179 |
| V. Applications | 190 |
| VI. Summary | 206 |
| References | 207 |

EQUILIBRIA OF MAGNETICALLY CONFINED PLASMAS

Brendan McNamara

| | |
|--|-----|
| I. Introduction | 211 |
| II. Toroidal Equilibrium | 215 |
| III. Anisotropic Pressure Equilibria | 231 |
| References | 249 |

COMPUTATION OF THE
MAGNETOHYDRODYNAMIC SPECTRUM
IN AXISYMMETRIC TOROIDAL CONFINEMENT SYSTEMS*Ray C. Grimm, John M. Greene, and John L. Johnson*

| | |
|--|-----|
| I. Introduction | 253 |
| II. Formulation of the Problem | 257 |
| III. Representation of the Normal-Mode Equations | 262 |
| IV. Application | 272 |
| V. Discussion | 276 |
| References | 278 |

COLLECTIVE TRANSPORT IN PLASMAS

John M. Dawson, Hideo Okuda, and Bernard Rosen

| | |
|---|-----|
| I. Introduction | 282 |
| II. The Simulation Model | 283 |
| III. Elementary Theory of Convective Diffusion in a Uniform Thermal Plasma | 289 |
| IV. The Simulation of Plasma Diffusion across a Magnetic Field (Uniform Thermal Plasma) | 295 |
| V. Simulation of Diffusion in Nonuniform Plasmas | 310 |
| References | 325 |

ELECTROMAGNETIC AND RELATIVISTIC
PLASMA SIMULATION MODELS*A. Bruce Langdon and Barbara F. Lasinski*

| | |
|--|-----|
| I. Introduction | 327 |
| II. Simulation of Collisionless Plasmas | 328 |
| III. Electromagnetic Codes Working Directly with E and B | 330 |
| IV. Algorithms with Special Stability Properties | 361 |
| V. SUPERLAYER | 363 |
| References | 364 |

PARTICLE-CODE MODELS IN THE NONRADIATIVE LIMIT

Clair W. Nielson and H. Ralph Lewis

| | |
|--|-----|
| I. Introduction | 367 |
| II. The Darwin Model | 368 |
| III. Hamiltonian Formulations | 371 |
| IV. Lagrangian Formulation | 374 |
| V. Solution of the Field Equations | 379 |
| VI. One-Dimensional Comparisons | 381 |
| VII. A Two-Dimensional Example | 384 |
| VIII. Summary | 386 |
| References | 387 |

THE SOLUTION OF THE KINETIC EQUATIONS
FOR A MULTISPECIES PLASMA*John Killeen, Arthur A. Mirin, and Marvin E. Rensink*

| | |
|--|-----|
| I. Introduction | 389 |
| II. Mathematical Model | 392 |
| III. Solutions Using Angular Eigenfunctions | 401 |
| IV. Finite-Difference Solution in a Two-Dimensional Velocity Space | 411 |
| References | 430 |
| AUTHOR INDEX | 433 |
| SUBJECT INDEX | 441 |
| CONTENTS OF PREVIOUS VOLUMES | 446 |