

CONTENTS

1. Invited Lectures

<i>D.E. Keyes</i> Aerodynamic Applications of Newton-Krylov-Schwarz Solvers	1
<i>A. Leonard, P. Koumoutsakos, G. Winckelmans</i> Vortex Methods for Three-Dimensional Separated Flows	21
<i>B. Mohammadi, O. Pironneau</i> On Wall Laws in CFD	31
<i>T.S. Prahlad</i> Status of CFD in India	39
<i>N.P. Weatherill, D.L. Marcum, A.J. Gaither, O. Hassan, M.J. Marchant</i> The Development of High-Quality Unstructured Grids on Parallel Computers	54

2. Valedictory Lecture

<i>A. Jameson</i> Computational Methods for Aerodynamic Design	71
---	----

3. Numerical Methods and Algorithms

a) Kinetic/Boltzmann Schemes

<i>J.-P. Croisille, R. Khanfir, G. Chanteur</i> A Kinetic Flux-Splitting Scheme for the MHD Equations	86
<i>S.S. Deshpande</i> A Boltzmann Taylor Galerkin FEM for Compressible Euler Equations	91
<i>J.-L. Estivalezes, P. Villedieu</i> A New Second-Order Positivity Preserving Kinetic Scheme for the Compressible Euler Equations	96
<i>A.K. Ghosh, S.M. Deshpande</i> A Robust Least Squares Kinetic Upwind Scheme for Euler Equations	101
<i>K. Xu, L. Martinelli, A. Jameson</i> Gas-Kinetic Finite Volume Methods	106
<i>S.V. Raghurama Rao</i> Peculiar Velocity Based Upwind Method for Inviscid Compressible Flows	112
<i>F. Rogier, J. Schneider</i> Discrete Boltzmann Equation for Solving Rarefied Gas Problems	117

b) Grids/Acceleration Techniques

<i>J.G. Andrews, K.W. Morton</i> Spurious Entropy Generation as a Mesh Quality Indicator	122
<i>R. Biswas, R.C. Strawn</i> Dynamic Mesh Adaptation for Tetrahedral Grids	127
<i>F. Chalot, C. Kasbarian, M.-P. Leclercq, M. Mallet, M. Ravachol, B. Stoufflet</i> Extensive Analysis and Cross-Comparisons of Past and Present Numerical Formulations for Flow Problems on Unstructured Meshes	133
<i>A. Chatterjee, G.R. Shevare</i> A Time-Accurate Multigrid Algorithm for Euler Equations	139
<i>M. Gazaix</i> Hypersonic Viscous Flow Computations with Solver and Grid Sensitivity Analysis	144
<i>J.P. Gregoire, G. Pot</i> Speed-Up of CFD Codes Using Analytical FE Calculations	149
<i>D. Hänel, R. Vilsmeier</i> A Field Method for 3-D Tetrahedral Mesh Generation and Adaption	155
<i>J.F. Lynn, B. van Leer</i> Multigrid Euler Solutions with Semi-coarsening and Local Preconditioning	161
<i>B.K. Soni, H. Thornburg</i> CAGD Techniques in Structured Grid Generation and Adaption	166
<i>S. Ta'asan</i> Canonical-Variables Multigrid Method for Euler Equations	173
<i>V. Venkatakrishnan, D.J. Mavriplis</i> Agglomeration Multigrid for the Euler Equations	178
<i>Zi-Niu Wu</i> Steady Transonic Flow Computations Using Overlapping Grids	183

c) Boundary Conditions

<i>A. Dadone, B. Grossman</i> Surface Boundary Conditions for the Numerical Solution of the Euler Equations in Three Dimensions	188
<i>W. Jia, Y. Nakamura</i> The Ψ - q Formulation and Boundary Condition for Incompressible Flows in Multi-connected Region	195

<i>C.P. Mellen, K. Srinivas</i> Treatment of Branch Cut Lines in the Computation of Incompressible Flows with C-Grids	201
<i>Yo Mizuta</i> Concepts on Boundary Conditions in Numerical Fluid Dynamics	206
<i>D. Schulze</i> Far Field Boundary Conditions Based on Characteristic and Bicharacteristic Theory Applied to Transonic Flows	211
<i>D. Sen</i> An Accurate Cubic-Spline Boundary-Integral Formulation for Two- Dimensional Free-Surface Flow Problems	216
<i>H.S. Udaykumar, W. Shyy</i> ELAFINT: A Computational Method for Fluid Flows with Free and Moving Boundaries	221
 d) Euler/Navier-Stokes Equations	
<i>R. Arina, F. Ramella</i> An Implicit Spectral Solver for the Compressible Navier-Stokes Equations in Complex Domains	228
<i>F. Bassi, S. Rebay</i> Accurate 2D Euler Computations by Means of a High-Order Discontinuous Finite Element Method	234
<i>L.A. Catalano, P. De Palma, G. Pascazio, M. Napolitano</i> A Higher-Order Multidimensional Upwind Solution-Adaptive Multigrid Solver for Compressible Flows	241
<i>V.V. Dedesh, I.V. Yegorov</i> On Some Advances in Fluid Flow Modeling Through Coupling of Newton Method and New Implicit PPV Schemes	246
<i>L. Flandrin, P. Charrier</i> An Improved Approximate Riemann Solver for Hypersonic Bidimensional Flows	251
<i>B. Fortunato, V. Magi</i> An Implicit Lambda Method for 2-D Viscous Compressible Flows	259
<i>J. Groenner, E. von Lavante, M. Hilgenstock</i> Numerical Methods for Simulating Supersonic Combustion	265
<i>A. Iollo, M.D. Salas, S. Ta'asan</i> Shape Optimization Governed by the Quasi 1D Euler Equations Using an Adjoint Method	274
<i>V. Karamyshev, V. Kovenya, S. Cherny</i> Relaxation Method for 3-D Problems in Supersonic Aerodynamics	280

<i>G.H. Klopfer, S. Obayashi</i> Virtual Zone Navier-Stokes Computations for Oscillating Control Surfaces	285
<i>J. Rokicki, J.M. Floryan</i> The Domain Decomposition Method and Compact Discretization for the Navier-Stokes Equations	287
<i>J. Szmelter, A. Pagano</i> Viscous Flow Modelling Using Unstructured Meshes for Aeronautical Applications	293
<i>I. Toumi, P. Raymond</i> Upwind Numerical Scheme for a Two-Fluid Two-Phase Flow Model	299
<i>M. Valorani, B. Favini</i> A Compact Formalism to Design Numerical Techniques for Three Dimensional Internal Flows	307
<i>S. Yamamoto, H. Nagatomo, H. Daiguji</i> An Implicit-Explicit Flux Vector Splitting Scheme for Hypersonic Thermochemical Nonequilibrium Flows	314
 e) Viscous and Turbulent Flows	
<i>Ch.-H. Bruneau, P. Fabrie</i> Computation of Incompressible Flows and Direct Simulation of Transition to Turbulence	320
<i>W.J. Decker, J. Dorning</i> Incomplete LU Decomposition in Nodal Integral Methods for Laminar Flow	325
<i>R. Friedrich, C. Wagner</i> On Turbulent Flow in a Sudden Pipe Expansion and Its Reverse Transfer of Subgrid-Scale Energy	330
<i>K.S. Muralirajan, K. Ghia, U. Ghia, B. Brandes-Duncan</i> Analysis of 3-D Unsteady Separated Turbulent Flow Using a Vorticity-Based Approach and Large-Eddy Simulation	337
<i>K. Ravi, K. Ramamurthi</i> Penalty Finite Element Method for Transient Free Convective Laminar Flow	343
<i>M. Si Ameur, J.P. Chollet</i> Numerical Simulation of Three Dimensional Turbulent Underexpanded Jets	348
<i>J. Steelant, E. Dick</i> Conditioned Navier-Stokes Equations Combined with the K-E Model for By-pass Transitional Flows	353

<i>V. Theofilis, D. Dijkstra, P.J. Zandbergen</i> Numerical Aspects of Flow Stability in the Veldman Boundary Layers	358
<i>S. Venkateswaran</i> Efficient Implementation of Turbulence Modeling for CFD	363
<i>M. Winkelsträter, H. Laschefske, N.K. Mitra</i> Transition to Chaos in Impinging Three-Dimensional Axial and Radial Jets	368
<i>G. Zhou, L. Davidson, E. Olsson</i> Transonic Inviscid/Turbulent Airfoil Flow Simulations Using a Pressure Based Method with High-Order Schemes	372
f) Miscellaneous Techniques	
<i>M. Arora, P.L. Roe</i> On Oscillations Due to Shock Capturing in Unsteady Flows	379
<i>H. Dang-Vu, C. Delcarte</i> An Example of Hopf Bifurcation and Strange Attractor in Chebyshev Spectral Approximations to Burgers Equation	385
<i>J. Fontaine, Loc Ta Phuoc</i> Simulation of the Unsteady Separated Flow Around a Finite Rectangular Plate Using a Free-Divergence Constraint Velocity-Vorticity Formulation	391
<i>Z. Gao, F.G. Zhuang</i> Time-Space Scale Effects in Computing Numerically Flowfields and a New Approach to Flow Numerical Simulation	396
<i>Y. Li, M. Rudman</i> An Evaluation of a Multi-dimensional FCT Algorithm with Some Higher-Order Upwind Schemes	402
<i>F. Nasuti, M. Onofri</i> Numerical Study of Unsteady Compressible Flows by a Shock Fitting Technique	407
<i>J.M. Pallis, J.-J. Chattot</i> Implementation of a Nonequilibrium Flow Solver on a Massively Parallel Computer	413
<i>B.B. Paulsen, M.D. Holst, T.J. Condra, J. Rusaas</i> Lagrangian Prediction of Particulate Two-Phase Flows at High Particle Loadings	418
<i>Jong-Youb Sa</i> A Numerical Method for Incompressible Viscous Flow Using Pseudocompressibility Approach on Regular Grids	423

<i>S.J. Sherwin, G.E. Karniadakis</i> Tetrahedral Spectral Elements for CFD	429
--	-----

4. Applications

<i>L. Bai, N.K. Mitra, M. Fiebig</i> Computation of Unsteady 3D Turbulent Flow and Torque Transmission in Fluid Couplings	435
<i>V.V. Bogolepov, I.I. Lipatov, L.A. Sokolov</i> Flow Investigation Near the Point of Surface Temperature and Catalytic Properties Discontinuity	441
<i>P.Y.P. Chen, M. Behnia, B.E. Milton</i> Computation of Air and Fuel Droplet Flows in S.I. Engine Manifolds	447
<i>K. Engel, F. Eulitz, M. Faden, S. Pokorny</i> Validation of TVD Schemes for Unsteady Turbomachinery Flow	454
<i>J. Fořt, M. Huněk, K. Kozel, J. Lain, M. Šejna, M. Vavřincová</i> Numerical Simulation of Steady and Unsteady Flows Through Plane Cascades	461
<i>E. Guilmineau, P. Queutey</i> Computation of Unsteady Viscous Flows past Oscillating Airfoils Using the CPI Method	466
<i>C. Hartmann, K.G. Roesner</i> Investigation of 3-D Shock Focusing Effects on a Massively Parallel Computer	472
<i>J. Mathew, A.J. Basu</i> The Mechanism of Entrainment in Circular Jets	476
<i>G. Mejak</i> Numerical Computation of Critical Flow over a Weir	481
<i>Y. Mochimaru</i> Numerical Simulation of a Natural Convection in a Cavity of an Ellipsoid of Revolution, Using a Spectral Finite Difference Method	485
<i>V.J. Modi, S.R. Munshi, G. Bandyopadhyay, T. Yokomizo</i> Multielement Systems with Moving Surface Boundary-Layer Control: Analysis and Validation	490
<i>N. O'Shea, C.A.J. Fletcher</i> Prediction of Turbulent Delta Wing Vortex Flows Using an RNG k - ε Model	496
<i>K. Oshima, H. Chen</i> Evaporative Flow in Heat Pipes — An Object Oriented System Analysis	502

<i>B. Ramakrishnananda, M. Damodaran</i> Numerical Study of Viscous Compressible Flow Inside Planar and Axisymmetric Nozzles	508
<i>N. Satofuka, T. Nishitani</i> Numerical Simulation of an Air Flow past a Moving Body with/ without Deformation	513
<i>S.K. Saxena, K. Ravi</i> Computation of Three Dimensional Supersonic and Hypersonic Blunt Body Flows Using High Resolution TVD Schemes Based on Roe's Approximate Riemann Solver	520
<i>S. Sekar, M. Nagarathinam, R. Krishnamurthy, P.S. Kulkarni, S.M. Deshpande</i> 3-D KFVS Euler Code "BHEEMA" as Aerodynamic Design and Analysis Tool for Complex Configurations	525
<i>W.L. Sickles, M.J. Rist, C.H. Morgret, S.L. Keeling, K.N. Parthasarathy</i> Separation Analysis of the Pegasus XL from an L-1011 Aircraft	530
<i>K.P. Singh, K. Murali Krishna, S. Saha, S.K. Mukharjea</i> Application of an Euler Code on a Modern Combat Aircraft Configuration	535
<i>D.J. Song, K.D. Kwon, S.Y. Won</i> Study on Hypersonic Finite-Rate Chemically Reacting Flows Using Upwind Method	540
<i>K.R. Sreenivas, P.K. Dey, Jaywant H. Arakeri, J. Srinivasan</i> Study of the Erosion of Stably Stratified Medium Heated from Below	551
<i>G.R. Srinivasan</i> Advances in Euler and Navier-Stokes Methods for Helicopter Applications	556
<i>C. Tenaud, Ta Phuoc Loc</i> Numerical Simulation of Unsteady Compressible Viscous Flow NACA 0012 Airfoil-Vortex Interaction	562
<i>S. Tokarcik-Polsky, J.-L. Cambier</i> A Numerical Study of Unsteady Flow Phenomena in the Driven and Nozzle Sections of Shock Tunnels	568
<i>Hsin-Hua Tsuei, C.L. Merkle</i> The Dynamics of Reacting Shear Layers Adjacent to a Wall	574
<i>Wang Wensheng, Zhang Fengxian, Xu Yanji, Chen Naixing</i> Validation of Two 3-D Numerical Computation Codes for the Flows in an Annular Cascade of High-Turning-Angle Turbine Blades	579
5. Author Index	586