

19th AIAA Computational Fluid Dynamics Conference 2009

**San Antonio, Texas, USA
22-25 June 2009**

Volume 1 of 4

ISBN: 978-1-61567-357-5

The contents of this work are copyrighted and additional reproduction in whole or in part are expressly prohibited without the prior written permission of the Publisher or copyright holder. The resale of the entire proceeding as received from CURRAN is permitted.

For reprint permission, please contact AIAA's Business Manager, Technical Papers. Contact by phone at 703-264-7500; fax at 703-264-7551 or by mail at 1801 Alexander Bell Drive, Reston, VA 20191, USA.

TABLE OF CONTENTS

VOLUME 1

A Meshless Volume Scheme	1
<i>A. Katz, A. Jameson</i>	
A Conservative Overset Mesh Scheme via Intergrid Boundary Reconnection on Unstructured Meshes	17
<i>M. Jung, O. Kwon</i>	
Comparison of Overset Grid and Grid Deformation Techniques Applied to 2-Dimensional NACA Airfoils	32
<i>C. Hoke, R. Decker, R. Cummings, D. McDaniel, S. Morton</i>	
Treatment of Non-Matched Grids for High-Accuracy RANS Solutions	43
<i>B. Epstein, S. Peigin</i>	
A Well-Balanced Approximate Riemann Solver for Variable Cross-Section Compressible Flows	70
<i>P. Helluy, J. Herard, H. Mathis</i>	
An Upwind Method for Incompressible Flow Computations Using Pseudo-Compressibility Approach	80
<i>J. Mandal, A. Iyer</i>	
Towards An 'All Speed' Unstructured Upwind Scheme	102
<i>C. Loh, P. Jorgenson</i>	
A Continuation Algorithm for Turbulent Flows Around a 2-D Airfoil	113
<i>C. Wales, A. Gaitonde, D. Jones</i>	
On AUSM-Family Scheme for All Speeds with Shock Detection for Carbuncle-Fix	133
<i>E. Shima, K. Kitamura</i>	
Panel-Free Boundary Conditions for Viscous Vortex Methods	149
<i>C. Cooper, L. Barba</i>	
Vortex Filament Simulation of the Turbulent Boundary Layer	161
<i>P. Bernard, P. Collins, M. Potts</i>	
Investigation of Vorticity Confinement in Compressible Flow	191
<i>T. Ton, A. Koop, H. Hoijmakers, H. de Vries</i>	
Stochastic Time-Dependent Boundary Conditions for the Burgers' Equation	211
<i>P. Pettersson, G. Iaccarino, J. Nordstrom</i>	
Influence of Weak and Strong Solid Wall Boundary Conditions on the Convergence to Steady-State of the Navier-Stokes Equations	225
<i>P. Eliasson, J. Nordstrom, S. Eriksson</i>	
Influence of the Discretization Order on the Accuracy of an Immersed-Boundary Procedure	240
<i>G. Bonfigli</i>	
Code Verification, Solution Verification and Validation: An Overview of the 3rd Lisbon Workshop	253
<i>L. Eca, M. Hoekstra, P. Roache</i>	
Towards Future Navier-Stokes Schemes: Uniform Accuracy, O(h) Time Step, and Accurate Viscous/Heat Fluxes	266
<i>H. Nishikawa</i>	
Software System for Prediction, Visualization, Analysis, and Reduction of Errors in CFD Simulations	290
<i>P. Cavallo, M. O'Gara, D. Schikore</i>	
Towards Accurate Flow Predictions Using Unstructured Meshes	307
<i>A. Cary, A. Dorgan, M. Mani</i>	
Analysis of Mesh and Boundary Effects on the Accuracy of Node-Centered Finite Volume Schemes	324
<i>S. Eriksson, J. Nordstrom</i>	
Method of Nearby Problems for Generating Exact Solutions to 1D Unsteady and 2D Steady Problems	346
<i>M. Kurzen, C. Roy, A. Sinclair, T. Phillips</i>	
Application of Richardson Extrapolation to the Numerical Solution of Partial Differential Equations in Two Dimensions	362
<i>C. Burg, T. Erwin</i>	
Implementation of Improved WENO Scheme to Higher Dimensions in Relation to Shock-Turbulence Interaction	382
<i>G. Arshed, K. Hoffmann</i>	
Improvement of Weighted Essentially Non-Oscillatory Schemes Near Discontinuities	399
<i>Y. Shen, G. Zha</i>	

A High-Order Parallel Newton-Krylov Flow Solver for the Euler Equations	414
<i>S. Dias, D. Zingg</i>	
Interface and Boundary Schemes for High-Order Methods	438
<i>X. Huan, J. Hicken, D. Zingg</i>	
High Order Interpolation Method for Overset Grid Using FVM	448
<i>K. Lee, J. Park, K. Kim</i>	
Implicit Weno Schemes With Anti-Diffusive Flux for the Compressible Viscous Flows	461
<i>J. Yang, T. Hsieh, C. Wang</i>	
CFD Modeling of F-35 Using Hybrid Unstructured Meshes	484
<i>S. Karman, P. Wooden</i>	
Suitability of Explicit Algebraic Stress Models for Predicting Complex Three-Dimensional Flows	506
<i>M. Weinmann, R. Sandberg</i>	

VOLUME 2

An Efficient Flow Solver with a Transport Equation for Modeling Turbulence	520
<i>R. Swanson, C. Rossow</i>	
Prediction of Separation-Induced Transition Using a Correlation-Based Transition Model	533
<i>F. Gisbert, R. Corral</i>	
A DES Procedure Applied to a Wall-Mounted Hump	544
<i>R. Bozinoski, R. Davis</i>	
Quantification of Uncertainties in Compressible Flows with Complex Thermodynamic Behavior	555
<i>P. Cinnella, P. Congedo</i>	
Uncertainty Quantification in Fluid-Structure Interaction Simulations Using a Simplex Elements Stochastic Collocation Approach	568
<i>J. Witteveen, H. Bijl</i>	
Control of Flow Separation and Transition Point over an Aerofoil at Low Re Number using Simultaneous Blowing and Suction	584
<i>M. Genc, U. Kaynak</i>	
Flow Simulation of a Controlled Airfoil With Synthetic Jet Actuators	604
<i>S. Jee, O. Lopez, R. Moser, A. Kutay, J. Muse, A. Calise</i>	
Aerodynamic Performance of Airfoils with Tangential Synthetic Jet Actuators Close to the Trailing Edge	617
<i>O. Lopez, D. Brzozowski, A. Glezer, R. Moser</i>	
Fully-Coupled Aeroelastic Computations of High Reynolds Number Flows: An Approach Using Large-Eddy Simulation	634
<i>M. Ilie</i>	
A Fluid-Structure Interaction Solver for Nano-Air-Vehicle Flapping Wings	645
<i>M. Olivier, J. Morissette, G. Dumas</i>	
Effect of Aspect Ratio on Nonlinear Interaction Between Vortex Shedding and Excitation Frequency in Canonical Flows	660
<i>I. Akhtar, M. Elyyan</i>	
A High-Order Collocation Penalty Formulation for Navier-Stokes Equations on 2-D Mixed Grids	677
<i>H. Gao, Z. Wang</i>	
A Spectral Difference Method for Viscous Compressible Flows With Shocks	695
<i>S. Premasuthan, C. Liang, A. Jameson</i>	
Analysis and Implementation of Recovery-Based Discontinuous Galerkin for Diffusion	711
<i>M. Lo, B. van Leer</i>	
Super-Convergence of Discontinuous Galerkin Method Applied to the Navier-Stokes Equations	726
<i>H. Atkins, B. Helenbrook</i>	
A Time Discontinuous Galerkin Method for the Unsteady Compressible Flows	739
<i>H. Luo, L. Luo</i>	
Entropy-Based Mesh Refinement, I: The Entropy Adjoint Approach	755
<i>K. Fidkowski, P. Roe</i>	
Entropy-Based Mesh Refinement, II: A New Approach to Mesh Movement	773
<i>D. Zaide, P. Roe</i>	
Validation of the Strand Grid Approach	788
<i>A. Wissink, A. Katz, W. Chan</i>	
Incompressible Flow Simulation at High Reynolds Numbers Using Galerkin Finite Element with Spatial/Temporal Adaptation	809
<i>M. Ebeida, R. Davis</i>	

Large-Eddy Simulation of Jet Mixing in a Supersonic Turbulent Crossflow	822
<i>S. Kawai, S. Lele</i>	
Direct Numerical Simulation of a Two-Dimensional Shocktube Using a Kinetic Energy Preserving Scheme	847
<i>Y. Allaneau, A. Jameson</i>	
A Novel Concept Towards the Reduction of Helicopter Blade-Vortex Interaction: A Numerical Study Using Large-Eddy Simulation	858
<i>M. Ilie</i>	
Turbulent Flow Simulations Around a Multi-Element Airfoil Using URANS, DES, and ILES Approaches	870
<i>B. Zhong, F. Scheurich, V. Titarev, D. Drikakis</i>	
DNS of Detonation Wave and Isotropic Turbulence	884
<i>H. Nagarajan, F. Lu, L. Massa</i>	
Adjoint-Based Design of Shock Mitigation Devices	901
<i>A. Stueck, F. Camelli, R. Lohner</i>	
Discrete Adjoint-Based Design Optimization of Unsteady Turbulent Flows on Dynamic Unstructured Grids	925
<i>E. Nielsen, B. Diskin, N. Yamaleev</i>	
Single- and Multi-Point Aerodynamic Shape Optimization Using a Parallel Newton-Krylov Approach	947
<i>T. Leung, D. Zingg</i>	
Adjoint Approach for Optimizing Boundary Layer Ingestion Offset Intake	963
<i>B. Lee, M. Liou, C. Kim</i>	
Continuous Eulerian and Lagrangian Sensitivities for the Design of Airfoils in Laminar Flow	982
<i>L. Charlot, J. Cori, S. Etienne, D. Pelletier</i>	

VOLUME 3

Multifidelity Geometry and Analysis in Aircraft Conceptual Design	1007
<i>D. Lazzara, R. Haines, K. Willcox</i>	
An Analysis of a Space-Time Discontinuous-Galerkin Method for Moment Equations and Its Solid-Boundary Treatment	1029
<i>L. Khieu, Y. Suzuki, B. van Leer</i>	
A General Formulation of Boundary Conditions on Cartesian Cut-Cells for Compressible Viscous Flow	1055
<i>D. Hartmann, M. Meinke, W. Schroder</i>	
Efficient Cartesian Mesh Approach for Flow Computations Around Moving and Deforming Bodies	1068
<i>T. Ishida, S. Takahashi, K. Nakahashi</i>	
A Hybrid Cartesian-Body Fitted Grid Approach for Simulations of Fluid Flows in Complex Geometries	1083
<i>X. Chen, G. Zha</i>	
Turbulent Flow Predictions Using a Cartesian Flow Solver	1101
<i>Y. Kidron, Y. Moryossef, Y. Levy</i>	
A Parallel Hybrid Finite Element/Volume Methods for Two-Immiscible Fluid Flows	1119
<i>T. Wan, S. Aliabadi, C. Bigler</i>	
Multidimensional Computations of a Two-Fluid Hyperbolic Model in a Porous Medium	1135
<i>J. Herard, L. Girault</i>	
Application of an AMR Strategy to an Abstract Bubble Vibration Model	1145
<i>Y. Penel, S. Dellacherie, A. Mekkas, J. Ryan, M. Borrel</i>	
Flow Structures and Fluid Transport for the Hydromedusa Sarsia Tubulosa	1157
<i>D. Lipinski, K. Mohseni</i>	
Overland Flow Modeling of Mississippi Coastal Region Using Finite Element Method	1174
<i>M. Akbar, S. Aliabadi, T. Wan, R. Patel</i>	
Large Eddy Simulation of Flows With Complex Moving Geometries: Application to Flying and Swimming in Animals	1188
<i>S. Ramakrishnan, R. Mittal, L. Zheng, F. Najjar</i>	
Computations of Turbulent Flow Over an Aircraft Windshield Wiper Model	1205
<i>M. Urban, K. Hoffmann</i>	
Computational Investigation of the Unsteady Flow Around a Parachute Model	1223
<i>L. Lobosky, S. Sander, M. McQuilling</i>	
A Solution Limiting Procedure for a High Order Space-Time Method	1238
<i>S. Tu</i>	

Development of a Higher Order CESE Scheme for Transient Viscous Flows	1257
<i>B. Venkatachari, G. Cheng, S. Chang</i>	
Accurate and Stable Calculations Involving Shocks Using a New Hybrid Scheme	1276
<i>Q. Abbas, E. Weide, J. Nordstrom</i>	
Multi-Dimensional Limiting Process on Triangular and Tetrahedral Meshes	1291
<i>J. Park, S. Yoon, C. Kim</i>	
Addition of Improved Shock-Capturing Schemes to OVERFLOW 2.1	1306
<i>R. Tramel, R. Nichols, P. Buning</i>	
A Second Order Front Tracking Solution of the Euler Equations	1345
<i>J. Witteveen</i>	
Enhancements to the Hybrid Mesh Approach to Surface Loads Integration on Overset Structured Grids	1356
<i>W. Chan</i>	
Automated Creation of Overset Grids Directly From Solid-Model Feature Trees	1371
<i>J. Dannenhoffer, R. Davis</i>	
Suggar++: An Improved General Overset Grid Assembly Capability	1381
<i>R. Noack, D. Boger, R. Kunz, P. Carrica</i>	
Automation of Structured Overset Mesh Generation for Rocket Geometries	1429
<i>S. Pandya, W. Chan, J. Kless</i>	
Three-Dimensional Elliptic Grid Generation with Fully Automatic Boundary Constraints	1448
<i>U. Kaul</i>	
Explicit Mesh Deformation Using Inverse Distance Weighting Interpolation	1463
<i>J. Witteveen, H. Bijl</i>	
Practical Software Engineering Strategies for Scientific Computing	1473
<i>C. Roy</i>	
OVERSMART: A Solution Monitoring and Reporting Tool for the OVERFLOW Flow Solver	1486
<i>D. Kao, W. Chan</i>	
Extension of CHIMPS for Unstructured Overset Simulation and Higher-Order Interpolation	1500
<i>S. Hahn, G. Iaccarino, S. Ananthan, J. Baeder</i>	
Data Mining of Pareto-Optimal Transonic Airfoil Shapes Using Proper Orthogonal Decomposition	1514
<i>A. Oyama, T. Nonomura, K. Fujii</i>	

VOLUME 4

Running Unstructured Grid Based CFD Solvers on Modern Graphics Hardware	1524
<i>A. Corrigan, F. Camelli, R. Lohner, J. Wallin</i>	
Implicit Large Eddy Simulation of Transitional Flows Over Airfoils and Wings	1535
<i>A. Uranga, P. Persson, M. Drela, J. Peraire</i>	
Convergence Acceleration for Simulation of Steady-State Compressible Flows Using High-Order Schemes	1552
<i>F. Iacono, G. May</i>	
Massively Parallel Solver for the High-Order Galerkin Least-Squares Method	1571
<i>M. Yano, D. Darmofal</i>	
Parallel Unstructured Three-Dimensional Turbulent Flow Analyses Using Efficiently Preconditioned Newton-Krylov Solvers	1588
<i>A. Bonfiglioli, B. Carpentieri, S. Campobasso</i>	
A Critical Study of Agglomerated Multigrid Methods for Diffusion	1608
<i>H. Nishikawa, B. Diskin, J. Thomas</i>	
Globalization Strategies for Inexact-Newton Solvers	1621
<i>J. Hicken, D. Zingg</i>	
Performances of Numerical and Analytical Jacobians in Flow and Sensitivity Analysis	1632
<i>A. Ezertas, S. Eyi</i>	
Finite Volume Diffusion Operators for Compressible CFD on Unstructured Grids	1658
<i>S. Veluri, C. Roy, E. Luke</i>	
Impact of Source Terms on Reliability of CFD Algorithms	1671
<i>C. Lian, G. Xia, C. Merkle</i>	
Simulation of Compressible Turbulent Flows with an Implicit LU-SGS Algorithm for High-Order Spectral Difference Method on Unstructured Grids	1692
<i>M. Parsani, K. Van den Abeele, C. Lacor, E. Turkel</i>	
Adjoint-Based Correction of Non-Converged CFD Solutions	1710
<i>C. Lozano, I. Ruiz</i>	

Shock/Boundary Layer Interaction Effects on Transverse Jets in Crossflow on a Body of Revolution	1725
<i>D. Dickmann, F. Lu</i>	
A 3-D Navier-Stokes Algorithm with Variable Chemistry Modelling for Re-Entry Nonequilibrium Flows	1735
<i>A. Preci, M. Fertig, M. Auweter-Kurtz</i>	
Direct Numerical Simulation of Ablation from an Internally Heated Turbulent Flow	1743
<i>Y. Dubief, J. Uhl, R. Crocker</i>	
Numerical Investigation of the Effect of Magnetic Fields on Strong Shocks and Shock/Boundary Layer Interaction	1750
<i>J. Ekaterinaris</i>	
A Level-Set Approach for n-Species, Compressible-Fluid Flows with Mass Transfer	1770
<i>M. Kinzel, J. Lindau, R. Kunz</i>	
Adaptive Cartesian Sharp Interface Method for Three-Dimensional Multi-Phase Flows	1808
<i>H. Kim, M. Liou</i>	
Computations of Two-Phase Interface Capturing Mixture Flow Models based on Preconditioning	1826
<i>Y. Niu</i>	
A General Framework for Solving High-Speed Multi-material Dynamics Problems with Local Mesh Adaptation	1840
<i>S. Sambasivan, H. UdayKumar</i>	
Nozzle Shape Optimization for Wet-Steam Flows	1865
<i>M. Giordano, P. Congedo, P. Cinne</i>	
Ice Accretion in Multi-Stage Jet Engines	1889
<i>X. Veillard, W. Habashi, M. Aube, G. Baruzzi</i>	
CFD Developments for Unsteady Aerodynamics of Rotorcraft in Forward Flight With Realistic Motion Schedules	1898
<i>S. Zhang, H. Xu, X. Zhao</i>	
Euler and Navier-Stokes Simulations of Helicopter Rotor Blade in Forward Flight Using an Overlapped Grid Solver	1925
<i>J. Kim, S. Park, Y. Yu</i>	
Sensitivity Analysis of Unsteady RANS Flows	1938
<i>E. Gammacurta, D. Pelletier, S. Etienne</i>	
Unsteady Flow Computation Using a Harmonic Balance Approach Implemented About the OVERFLOW 2 Flow Solver	1961
<i>J. Thomas, C. Custer, E. Dowell, K. Hall</i>	
A NLFD Method for the Simulation of Periodic Unsteady Flows for Overset Meshes	1975
<i>O. Soucy, S. Nadarajah</i>	
Simulation of Low Reynolds Number Airfoil Subjected to High Frequency Pitch/Plunge	1996
<i>V. Vytla, G. Huang, N. Watanabe</i>	
An Assessment of Dual-Time Stepping, Time Spectral and Artificial Compressibility Based Numerical Algorithms for Unsteady Flow with Applications to F1	2010
<i>A. Jameson, S. Shankaran</i>	
Effect of Small-Scale Unsteadiness on Adjoint-Based Output Sensitivity	2031
<i>J. Krakos, D. Darmofal</i>	
Collocation and Galerkin Time-Stepping Methods	2044
<i>H. Huynh</i>	
Author Index	