

Dudley Stephen Nichols, III

Education

PhD, Engineering (Emphasis on Aerospace Engineering), Mississippi State University, August 2002
MS, Aerospace Engineering (Minor, Mechanical Engineering), Mississippi State University, May 1998
BS, Aerospace Engineering (Emphasis on Astrodynamics), United States Naval Academy, May 1992

Employment

Computational Scientist, Center for Computational Sciences, Oak Ridge National Laboratory, November 2019-Present
Assistant Professor, Department of Aerospace Engineering, Auburn University, August 2016-October 2019
Associate Research Professor, Department of Aerospace Engineering, Auburn University, August 2015-August 2016
Associate Research Professor, SimCenter, University of Tennessee at Chattanooga, July 2008-August 2015
Assistant Research Professor, SimCenter, University of Tennessee at Chattanooga, Aug 2002- June 2008
Research Associate, SimCenter, Engineering Research Center, Mississippi State University, Sept 1999-Aug 2002
Aerospace Engineer, Naval Surface Warfare Center Dahlgren Division (NSWCDD), Feb 1999-Aug 1999
Project Engineer, USMC Lightweight Laser Rangefinder Designator Program, NSWCDD, Sept 1998- Jan 1999
Graduate Research Assistant, MSU-NSF Engineering Research Center, Mississippi State University, May 1994-Sept 1998
Naval Officer, Ensign, United States Navy, May 1992-April 1994

Research Efforts in Computational Fluid Dynamics

Parallel Unstructured and Structured Flow Solvers
Unsteady Free-Surface Flows
Turbulence Modeling
Multi-Phase and Multi-Species Modeling
Turbomachinery
Meshless Smoothed Particle Hydrodynamics

Preconditioned Equations
Surface-Ship Hydrodynamics and Maneuvering
Atmospheric Modeling
Source Term Utilization
Flood Control and Disaster Mitigation
Grid Generation

Scientific Supercomputing Experience

17 years of professional experience as a Code Developer (C/C++) for *Tenasi*, the highly scalable, parallel, general multi-element, unstructured flow solver developed at the SimCenter: National Center for Computational Engineering

- Developed and Implemented an Incompressible Multi-Species model with Total Energy Conservation
- Improved and validated 2 preconditioned mathematical models for multi-phase and multi-species flows
- Implemented 7 turbulence models and improved the sub-grid scale modeling of the 7 models
- Developed 2 atmospheric models that support full atmospheric stratification and gravitational potential
- Responsible for general code maintenance, debugging, and development of new features as needed

3 years of professional experience as a Code Developer (C/C++/Fortran) for U^2 NCLE, the highly scalable, parallel, general multi-element, unstructured flow solver developed at the Mississippi State University SimCenter

- Implemented and Improved a Multi-Phase Surface Capturing model to study Surface-Ship and Underwater-Vehicle Hydrodynamics and Maneuvering
- Responsible for general code maintenance, debugging, and development of new features as needed

General Software Development

20 years of professional experience with

- High Performance Scientific Supercomputing
- Mathematical Modeling and High-Resolution Computational Algorithm Development
- C, C++ (Object-Oriented) and Fortran Programming in Unix/Linux Environments
- Parallel programming for distributed (MPI), shared address (OpenMP) memory spaces and GPUs (CUDA)
- Shell and Python scripting in Unix/Linux environments
- Moderate experience with Netbeans and Eclipse IDEs in Linux environments
- Version Control using RCS, SVN, and GIT
- Daily code testing to ensure proper and consistent solutions before and after source code modifications

Synergistic Activities

Member of AIAA Meshing, Visualization, and Computational Environments (MVCE) Technical Committee
Faculty Advisor AIAA Student Chapter at Auburn University
Provide and Manage Access to HPC Resources for Auburn University Aerospace Department
Director of the Computational Fluid Dynamics Lab at Auburn University

Academic Service

Undergraduate Teaching Experience: ENGR 1040 Vector Statics (UT Chattanooga)
ENGR 3050 Thermo-Fluids (UT Chattanooga)
AERO 3110 Aerodynamics I (Auburn University)
AERO 4140 Aerodynamics III (Auburn University)
AERO 4970 Intro to CFD (Auburn University)

Graduate Teaching Experience: ENCM 5210 Introduction to Parallel Programming (UT Chattanooga)
ENCM 7210 Parallel Scientific Supercomputing (UT Chattanooga)
AERO 7970 Special Topics: Intro to CFD (Auburn University)
AERO 7140 Advanced CFD (Auburn University)
AERO 7970 Scientific Supercomputing (Auburn University)
AERO 7970 Theory of Computations (Auburn University)

Reviewer

Journal of Ship Research Computers & Fluids Journal of Fluids Engineering AIAA Journal

Book Chapters

1. Adhikari, N. and Nichols, D.S., "Grid Generation About High Lift Wing Configurations", *Numerical Simulation of the Aerodynamics of High-Lift Configurations*, ISBN:978-3-319-62135-7, Springer, May 2018.
2. Adhikari, N. and Nichols, D.S., "Incompressible Solutions About High Lift Wing Configurations", *Numerical Simulation of the Aerodynamics of High-Lift Configurations*, ISBN:978-3-319-62135-7, Springer, May 2018.

Papers

1. Eagan, G and Nichols D.S., "Turbulence Transition Modeling for Incompressible Flows Using Unstructured Meshes", *In preparation*
2. Eagan, G., Nichols, D.S., and Bevly, D. "CFD Simulations of Tractor Trailer Platooning for Drag Reduction", *In preparation*
3. Hu, J. and Nichols, D.S., "Modeling Non-Hydrostatic Atmospheric Flows on Unstructured Meshes", *In Preparation*
4. Siemon, M. and Nichols, D.S., "CFD Analysis of Heterogeneous and Homogeneous Multi-Truck Platoon Aerodynamic Drag Reduction", AIAA Paper 2018-3862, AIAA Fluid Dynamics Conference, Atlanta, GA, June 2018
5. Siemon, M., Smith, P., Nichols, D.S., Bevly, D., and Helm, S., "An Integrated CFD and Truck Simulation for 4 Vehicle Platoons," WCX Paper 2018-01-0797, WCX: SAE World Congress Experience, Detroit, MI, April 2018.
6. Siemon, M. and Nichols, D.S., "A Numerical Investigation of Vortex Dynamics about a Streamlined Cylinder at Various Aspect Ratios", AIAA Paper 2017-3307, 47th AIAA Fluid Dynamics Conference, Denver, CO, June 2017.
7. Hereth, E.A., Sreenivas, K., Taylor, L.K., and Nichols, D.S., "Automatic Parallel Octree Grid Generation Software with an Extensible Solver Framework and a Focus on Urban Environments", AIAA Paper 2017-0587, 55th AIAA Aerospace Sciences Meeting, Grapevine, TX, January 2017.
8. Mittal, A., Taylor, L, Sreenivas, K, Nichols, D.S, and Briley, W.R., "Extension of a Parabolic Method without Pressure Approximations for Wind Turbines in ABL Flows", AIAA Paper 2015-3391, 33rd AIAA Applied Aerodynamics Conference, Dallas, TX, June 2015.
9. Nichols, III, D. S., "Accounting for Shocks in Turbulence Modeling," 41st AIAA Fluid Dynamics Conference, Honolulu, Hawaii, June, 2011.
10. Hyams, D.G., Sreenivas, K., Pankajakshan, R., Nichols, III, D.S., Briley, W.R., and Whitfield, D.L., "Computational simulation of model and full scale Class 8 trucks with drag reduction devices," *Computers & Fluids*, Volume 41, Issue 1, February 2011, Pages 27-40.
11. M. Hajjawi, L. Taylor, and S. Nichols, "Assessment and Modification for Reynolds Stress Transport Turbulence Model Flow Prediction," AIAA-2008-568, 46th AIAA Aerospace Sciences Meeting and Exhibit, Reno, NV, Jan. 7-10, 2008.
12. M. Hajjawi, L. Taylor, and S. Nichols, "Assessment of Filtered-Based RANS Turbulence Model For Unsteady Separated Flow Prediction," AIAA-2008-670, 46th AIAA Aerospace Sciences Meeting and Exhibit, Reno, Nevada, Jan. 7-10, 2008.

13. S. Nichols, K. Sreenivas, S. Karman and B. Mitchell, "Turbulence Modeling for Highly Separated Flows," AIAA-2007-1407, 45th AIAA Aerospace Sciences Meeting and Exhibit, Reno, Nevada, Jan. 8-11, 2007.
14. K. Sreenivas, B. Mitchell, S. Sawyer, S. Karman, S. Nichols, and D. Hyams, "Computational Prediction of Forces and Moments for Transport Aircraft," AIAA-2007-1088, 45th AIAA Aerospace Sciences Meeting and Exhibit, Reno, Nevada, Jan. 8-11, 2007.
15. K. Sreenivas, S. Nichols, D. Hyams, B. Mitchell, S. Sawyer, and D. Whitfield, "Computational Simulation of Heavy Trucks," AIAA-2007-1087, 45th AIAA Aerospace Sciences Meeting and Exhibit, Reno, Nevada, Jan. 8-11, 2007.
16. A. Arabshahi, K. Sreenivas, S. Nichols, B. Mitchell, L. Taylor and D. Whitfield, "Computational Analysis of Turbulent Internal Flow in Ballistic Rocket Motors," AIAA-2007-1449, 45th AIAA Aerospace Sciences Meeting and Exhibit, Reno, Nevada, Jan. 8-11, 2007.
17. Wilson, R.V., Nichols, D.S., Mitchell, B., Karman, S.L., Hyams, D.G., Sreenivas, K., Taylor, L.K., Briley, W.R., and Whitfield, D.L., "Application of an Unstructured Free Surface Flow Solver for High Speed Transom Stern Ships," 26th Symposium on Naval Hydrodynamics, Rome Italy, September. 17-22, 2006.
18. S. Nichols, B. Mitchell, K. Sreenivas, L. Taylor, D. Whitfield and R. Briley, "Aerosol Propagation in an Urban Environment," AIAA 2006-3726, June 2006.
19. S. Nichols, D. Hyams, K. Sreenivas, B. Mitchell, L. Taylor, D. Whitfield, "An Unstructured Incompressible Multi-Phase Solution Algorithm", AIAA-2006-1290, 44th AIAA Aerospace Sciences Meeting and Exhibit, January 2006.
20. K. Sreenivas, R. Pankajakshan, S. Nichols B. Mitchell, L. Taylor, D. Whitfield, "Aerodynamic Simulation of Heavy Trucks with Rotating Wheels", AIAA-2006-1394, 44th AIAA Aerospace Sciences Meeting and Exhibit, January 2006.
21. Sreenivas, K., Hyams, D., Nichols, S., Mitchell, B., Taylor, L., Briley, R., Whitfield, D., *Development of an Unstructured Parallel Flow Solver for Arbitrary Mach Numbers*, 43rd AIAA Aerospace Sciences Meeting and Exhibit, AIAA 2005-0325, January 2005
22. Nichols, D. S. III, *Development of a Free Surface Method Utilizing an Incompressible Multi-Phase Algorithm to Study the flow about Surface Ships and Underwater Vehicles*, Doctoral Thesis, Mississippi State University, August 2002
23. Hyams, D.G., Sreenivas, K., Sheng, C., Nichols, S., Taylor, L.K., Briley, W.R., and Whitfield, D.L., *An Unstructured Multielement Solution Algorithm for Complex Geometry Hydrodynamic Simulations*, 23rd Symposium on Naval Hydrodynamics, Val de Reuil, France, September 2000.
24. Beddhu, M., Nichols, S., Jiang, M.Y., Sheng, C., Whitfield, D.L., and Taylor, L.K., *Comparison of EFD and CFD Results of the Free Surface Flow Field about the Series 60 $C_B = 0.6$ Ship*, 25th American Towing Conference, Iowa City, IA, Sept. 1998
25. Nichols, D. S. III, *Calculation of Free Surface Wave Forms and Flow Field about the Series 60 $C_B = 0.6$ Ship*, Masters Thesis, Mississippi State University, May 1998

External Funding

DOE/ACM Fuel Efficient Platooning in Mixed Traffic Highway Environments (Co-PI: Critical Technology Contributor: High-Fidelity CFD Simulations of Truck Platoons in Multiple Configurations)	\$393,646 and \$274,284 Auburn Cost Share	2018-2020
Integrated Solutions for Systems (IS4S)/Army Fuel Efficiency for Tactical Wheel Vehicles and Convoys (Co-PI: Critical Technology Contributor: High-Fidelity CFD Simulations of Truck Platoons in Multiple Configurations)	\$200,000	2018-2019
Bush Hog, Inc (PI: Numerical Simulations of Flow Patterns Under Multiple Three-Bladed Mowing Decks)	\$5,500	2019
CHI, Engineering Risk Mitigation for Commercial Point (Extended) (PI: Stephen Nichols)	\$44,000	2017-2018
Integrated Solutions For Systems (IS4S)/Army (Co-Investigator: Critical Technology Contributor: High-Fidelity CFD Simulations of Truck Platoons in Multiple Configurations)	\$30,000	2017

Federal Highway Administration	\$1,419,420 and \$449,214 Auburn Cost Share	2013-2019
Heavy Truck Cooperative Adaptive Cruise Control: Evaluation, Testing, and Stakeholder Engagement for Near Term Development (Co-PI: Critical Technology Contributor: High-Fidelity CFD Simulations of Truck Platoons in Multiple Configurations)		
CHI, Engineering	\$22,000	2017
Risk Mitigation for Commercial Point (PI: Stephen Nichols)		
Auburn University Intramural Grant Program	\$40,000	2017-2019
An Experimental and Numerical Study of the Environmental and Combustion Characteristics of Wildland Fuels (Co-Investigator: Critical Technology Contributor: Develop Reduced-Order Computational Tool for Quick Prediction of Wildland Fires and Perform High-Fidelity CFD Simulations of Typical Wildland Fuels)		
CHI, Engineering	\$63,000	2015-2017
National Grid Risk Mitigation (PI: Stephen Nichols)		
CHI, Engineering	\$184,760	2014-2015
Physics-Based Simulation of Potential LNG Spillage (PI: Stephen Nichols)		
Office of Naval Research	\$220,000	2013-2014
Hydrodynamic Drag Reduction (Co-Investigator, Critical Technology Contributor: Free-Surface and Advanced Turbulence Modeling for Unstructured Topologies Undergoing 6-DOF Simulations)		
CoE Appl. Comp. Sci. Engr.	\$30,000	2013-2014
Incompressible Multi-Species Flow Regime with Total Energy Conservation (PI: Stephen Nichols)		
CoE Appl. Comp. Sci. Engr.	\$20,000	2013-2014
Transition Modeling for Improved Heat Transfer Computations for Turbomachinery (PI: Stephen Nichols)		
CoE Appl. Comp. Sci. Engr.	\$10,000	2013-2014
Design of a Coronary Stent for Reduced Failure Rate (PI: Stephen Nichols)		
SimCenter Enterprises, Inc.	\$15,000	2013-2014
Simplified Modeling of Buoyant, Precipitant, and Explosive Events with the Scalar Transport Model (PI: Stephen Nichols)		
The Washington, DC Project	\$99,000	2012-2013
(Co-Investigator, Critical Technology Contributor: Time-Dependent Atmospheric Computations with Buoyancy and Advanced Turbulence Modeling)		
National Science Foundation US Ignite Program Grant	\$224,658	2012-2013
Disaster Mitigation System (Co-Investigator, Critical Technology Contributor: Time-Dependent Atmospheric Computations with Buoyancy and Advanced Turbulence Modeling)		
SimCenter Enterprises, Inc.	\$56,886	2012-2013
Coupling of the Weather Research & Forecast Model (WRF) and Tenasi for Atmospheric Simulations (PI: Stephen Nichols)		
SimCenter Enterprises, Inc.	\$43,273	2012-2013
Reducing Large Urban Environment Simulations for Time-Critical Predictions (PI: Stephen Nichols)		

SimCenter Enterprises, Inc. Temperature Generated Turbulence in Buoyant Flow Fields (PI: Stephen Nichols)	\$29,958	2012-2013
SimCenter Enterprises, Inc. Turbulence Modeling for High Energy Flows (PI: Stephen Nichols)	\$26,614	2011-2012
SimCenter Enterprises, Inc. Buoyant Atmospheric Simulations (PI: Stephen Nichols)	\$55,606	2011-2012
CoE. Appl. Comp. Sci. Engr. Applications of SimCenter Hybrid RANS/LES Code (PI: Stephen Nichols)	\$80,615	2011-2012
SimCenter Enterprises, Inc. Simulations for Buoyant Multi-Species Flows (PI: Stephen Nichols)	\$91,755	2010-2011
CoE Appl. Comp. Sci. Engr Modeling Turbulence Kinetic Energy for High Energy Flows (PI: Stephen Nichols)	\$31,345	2010-2011
CoE Appl. Comp. Sci. Engr. Simulations With Gravity On Multi-Element Unstructured Topologies (PI: Stephen Nichols)	\$89,720	2009-2010
CoE Appl. Comp. Sci. Engr. Atmospheric Wind Modeling for Regional Simulations (PI: Stephen Nichols)	\$42,125	2008-2009
CoE Appl. Comp. Sci. Engr. Turbulence Modeling for Multi-Speed Flows (PI: Stephen Nichols)	\$77,000	2007-2009
Jackson & Tull/Air Force Research Lab Turbomachinery CFD Analysis (Co-Investigator, Critical Technology Contributor: Boundary Conditions and Advanced Turbulence Modeling)	\$120,000	2007
Office of Naval Research Unstructured Viscous Free Surface Solver for Predicting Hydrodynamic Performance of High Speed Ships (Co-Investigator, Critical Technology Contributor: Free-Surface and Advanced Turbulence Modeling for Unstructured Topologies)	\$1,056,000	2006-2009
Department of Energy Atmospheric Dispersion at Spatial Resolutions Below Mesoscale (Co-Investigator, Critical Technology Contributor: Atmospheric Modeling, Source Term Utilization, and Advanced Turbulence Modeling for Unstructured Topologies)	\$579,000	2005-2008
CoE Appl. Comp. Sci. Engr. Advanced Turbulence Modeling for Unstructured Topologies (PI: Stephen Nichols)	\$166,000	2005-2007
Barber-Nichols, Inc. CFD Tool Validation for Upper Stage, Turbo-Pump, Design (Co-Investigator, Critical Technology Contributor: Advanced Turbulence Modeling)	\$178,000	2005

ITT Industries, Inc. Post-Engagement Ground Effects Model (PEGEM) Independent Validation & Verification (Co-Investigator, Critical Technology Contributor: Unsteady Atmospheric Simulations for Aerosol Contaminant Transport)	\$100,000	2005
Department of Energy Global Climate Change (Co-Investigator, Critical Technology Contributor: Atmospheric Modeling, Advanced Turbulence Modeling, Source Term Utilization)	\$725,000	2004-2007
Office of Naval Research (DARPA) Simulation and Analysis of Proposed Underwater Vehicles (Co-Investigator, Critical Technology Contributor: 6-DOF and Advanced Turbulence Modeling)	\$150,000	2004
ATA/AEDC Engine Inlet Distortion Simulations (Co-Investigator, Critical Technology Contributor: Boundary Conditions and Advanced Turbulence Modeling)	\$40,000	2004