Andrew Cary

Boeing Research & Technology
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Experience

1996 – PRESENT

Technical Fellow, CFD / Boeing Research & Technology

Develop and apply Computational Fluid Dynamics (CFD) tools and processes across range of Boeing products from low speed to hypersonic. Primary focus is on development of unstructured grid finite volume flow solver and supporting processes, particularly those requiring time-accurate analysis.

1999 – PRESENT

Adjunct Professor / Washington University, St. Louis

Teach graduate level CFD and Fluid Dynamics classes in the Mechanical Engineering department

Education

AUGUST 1997

Ph. D., Aerospace Engineering

University of Michigan, Ann-Arbor

Thesis title: The onset of non-axisymmetric vortex breakdown, Advisors: Ken Powell and David Darmofal

AUGUST 1993

M.S., Aeronautical and Astronautical Engineering

University of Illinois, Urbana-Champaign

MAY 1992

B.S., Aeronautical and Astronautical Engineering

University of Illinois, Urbana-Champaign

4.0 GPA. Knight of St. Patrick. Recognized by USA Today among top engineering graduates.

Professional Activities

- American Institute of Aeronautics and Astronautics: Senior member. CFD Vision 2030 Integration Committee (Chair, Roadmap Subcommittee). Fluids Dynamic Technical Committee (2013-2015). Instructor for “Introduction to Flow Control” short course (2012). Advisor to St. Louis Section. Published over 40 conference papers and multiple journal articles.
- Project Lead The Way, Community advisory council for Francis-Howell school district. Past president

Selected Publications

- "Microkernel Optimization for an Industrial Unstructured Grid Computational Fluid Dynamic Solver." Andrew Cary, Mark Fisher, and Levi Barnes. NVIDIA GPU Technology Conference (GTC). 2020.
- "Multi-fidelity Modeling of Probabilistic Aerodynamic Databases for Use in Aerospace Engineering." Jayant Mukhopadhaya, Brian Whitehead John Quindlen, Juan Alonso, and Andrew Cary. *International Journal for Uncertainty Quantification*. 10(5):425-447. 2020.
- "Uncertainty Quantification across Design Space using Spatially Accurate Polynomial Chaos." John Schaefer, Andrew Cary, Mori Mani, and Tom Grandine. AIAA 2020-1416
- "Application of a CFD Uncertainty Quantification Framework for Industrial-Scale Aerodynamic Analysis." John Schaefer, Andrew Cary, Earl Duque, and Seth Lawrence. AIAA 2019-1492
- "CFD Verification and Validation for Industrial Applications." Mori Mani and Andrew Cary. 31st Congress of the International Congress of the Aeronautical Sciences. 2018.
- Grid Influence on Turbulence Model Coefficient Uncertainties in Transonic Wall-Bounded Flows." John Schaefer, Andrew Cary, Mori Mani, Joshua Krakos, and Serhat Hosder. AIAA Journal Vol 56, No.8. 2018
- "Uncertainty Quantification and Sensitivity Analysis of SA Turbulence Model Coefficients in Two and Three Dimensions." John Schaefer, Andrew Cary, Mori Mani, and Philippe Spalart. AIAA 2017-1710
- "Current Practice Unstructured Grid CFD Results for the 3rd AIAA High Lift Prediction Workshop." Andrew Cary, Mohamed Yousef, Pei Li, and Mori Mani. AIAA 2018-1037
- "Development of a Coupled Compressible Pressure-Based Solver." Prasanth Kambrath and Andrew Cary. AIAA 2014-0226
- "Unstructured grid solution accuracy and mesh dependency." Andrew Cary, Andrew Dorgan, and Mori Mani. AIAA 2010-0028
- "Finite rate chemistry implementation and validation for unstructured grids." Andrew Dorgan, Andrew Cary, and Mori Mani. AIAA 2010-0030
- "RANS Technology for transonic drag prediction: A Boeing perspective on the 4th drag prediction workshop." Mori Mani, Ben Rider, Anthony Sclafani, Chad Winkler, John Vassberg, Andrew Dorgan, Andrew Cary, and Edward Tinoco. AIAA 2010-4221
- "Towards accurate flow predictions using unstructured meshes." Andrew Cary, Andrew Dorgan, and Mori Mani. AIAA 2009-3650
- "A general purpose Euler and Navier-Stokes solver for structured and unstructured grids." Mori Mani, Andrew Cary, S.V. Ramakrishnan. Journal of Aircraft, v. 42 (4). pp 991-997. July 2005.
- "A structured and hybrid-unstructured grid Euler and Navier-Stokes solver for general geometry." Mori Mani, Andrew Cary, S.V. Ramakrishnan. AIAA 2004-0524
- "High-Frequency Excitation Active Flow Control for High-speed Weapon Release (HIFEX)." William Bower, Valdis Kibens, Andrew Cary, Farrukh Alvi, Ganesh Raman, Anna Annaswamy, and Norm Malmuth. AIAA 2004-2513
- "Uncertainty Management for Store Separation using the Belief Function Calculus." Andrew Cary and Len Wesley. American Society of Civil Engineers Conference on Probabilistic Methods (PMC2004). 2004.
- "F-111 Store Trajectory Analysis." Rudy Johnson and Andrew Cary. NATO RTO AVT Symposium on "Functional and Mechanical Integration of Weapons and Land and Air Vehicles". RTO-MP-AVT-108. 2004.
- "Accurate Flow Prediction for Store Separation from Internal Bay." Mori Mani, Andrew Cary, and William Bower. ICCFD3. 2004.
- "A different approach to assessing the uncertainty associated with a store trajectory." Andrew Cary, William Bower, and Len Wesley. Aircraft-Sores Compatibility Symposium XIII. 2003.

- "Overview of Numerical Simulations of Electromagnetic Turbulence Control (EMTC)." Andrew Cary, John Donovan, and Linda Kral. In *Turbulence Structure and Modulation*. Interational Centre for Mechanical Sciences. SpringerWienNewYork. 2001
- "Simulations of Synthetic Jets and Application to Airfoil Control." Andrew Cary, John Donovan, and Linda Kral. In *Turbulence Structure and Modulation*. Interational Centre for Mechanical Sciences. SpringerWienNewYork. 2001
- "Generalized prisms for improved grid quality." Andrew Cary and Todd Michal. AIAA 2001-2552
- "Unstructured grid extrusion for viscous flow simulations." Todd Michal and Andrew Cary. AIAA 2001-0444
- "Modeling and prediction of acoustic resonance for round supersonic jets." Andrew Cary, William Bower, Alan Cain, Edward Kerschen. American Society of Mechanical Engineers, Dynamic Systems and Control Division (DSC) vol 68. pp 113-120. 2000
- "An analytical asymptotic solution method for 2D transonic inviscid flow." August Verhoff and Andrew Cary. AIAA 1999-0173
- "Analytical Euler solutions for 2D flows with corners using asymptotic methods." August Verhoff, and Andrew Cary. AIAA 1998-2687
- "A new approach for efficient construction of asymptotic solutions of the two-dimensional Euler equations." August Verhoff, Andrew Cary, and Ron Epstein. AIAA 1998-0122
- "Active flow control applied to an airfoil." John Donovan, Linda Kral, and Andrew Cary. AIAA 1998-0210
- "Numerical simulations of synthetic jet actuators." Linda Kral, John Donovan, Alan Cain, and Andrew Cary. AIAA 1997-1824
- "Numerical simulation and analysis of flow control using electromagnetic forcing." Linda Kral, John Donovan, and Andrew Cary. AIAA 1997-1797
- "Characterization of a Lorentz force actuator." John Donovan, Linda Kral, and Andrew Cary. AIAA 1997-1918
- "Evolutions of asymmetries in vortex breakdown." Andrew Cary, David Darmofal, and Ken Powell. AIAA 1998-2904
- "Onset of the spiral mode of vortex breakdown." Andrew Cary, David Darmofal, and Ken Powell. AIAA 1997-0439
- "Wave propagation characteristics of vortical flows in varying-area pipes." David Darmofal, Andrew Cary, and Ken Powell. AIAA 1995-0023

Publications with Students

- "Aero-optical analysis of shear layers over 2D cavities with steady and pulsed blowing and comparisons with experimental data - II." Yan Tan, Ramesh Agarwal, William Bower, and Andrew Cary. AIAA 2005-0489
- "Aero-optical analysis of shear layers over 2D cavities with steady and pulsed blowing and comparison with experimental data." Yan Tan, Ramesh Agarwal, William Bower, and Andrew Cary. AIAA 2004-2122
- "Flow control with synthetic and pulsed jets: Applications to virtual aeroshaping, thrust-vectoring, and control of separation and cavity oscillations." Ramesh Agarwal, Jose Vadillo, Yan Tan, Jing Cui, Himani Jain, Andrew Cary, and William Bower. AIAA 2004-0746
- "Flow control of shear layers over 2D cavities using pulsed jet and aero-optical analysis." Yan Tan, Ramesh Agarwal, William Bower, and Andrew Cary. AIAA 2004-0428
- "Numerical simulation of the interaction of a synthetic jet with a turbulent boundary layer." Jing Cui, Ramesh Agarwal, and Andrew Cary. AIAA 2003-3458
- "Numerical simulation of the influence of a synthetic jet on recirculating flow over a backward facing step." Himani Jain, Ramesh Agarwal, and Andrew Cary. AIAA 2003-1125

- “Numerical study of virtual aerodynamic shape modification of an airfoil using a synthetic jet actuator.” Jose Vadillo, Ramesh Agarwal, Andrew Cary, and William Bower. AIAA 2003-4158
- “Numerical study of behavior of synthetic jets in cross flow.” Jing Cui, Ramesh Agarwal, Dahai Guo, and Andrew Cary. AIAA 2003-1264
- “Vectoring Control of a primary jet with synthetic jets.” Dahai Guo and Andrew Cary. AIAA 2001-0738
- “Parametric and dynamic modeling for synthetic jet control of a post-stall airfoil.” Yanyu He, Andrew Cary, and Dave Peters. AIAA 3001-0733
- “Numerical simulations of the interaction of adjacent synthetic jet actuators.” Dahai Guo, Linda Kral, and Andrew Cary. AIAA 2000-2565