Christopher Cox

U.S. Citizen
Curriculum Vitae

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Research Interests

My current research involves development of Huynh's high-order flux reconstruction method for solving large-scale fluid flow problems on unstructured grids using high performance parallel computing. Covergence acceleration techniques adopted include implict dual time stepping and *p*-multigridding. The current numerical solver has been used to simulate pulsatile flow of a blood-analog fluid through an idealized model of a curved artery. The goals of this work are to identify three-dimensional vortices caused by pulsatile secondary flow and correlate vortex evolution with relevant haemodynamic metrics used to assess local variation in blood flow characteristics as it relates to the progression of atherosclerosis. This work was done in collaboration with experimentalists to validate results and answer fundamental questions of the underlying flow physics. In the recent past, my research involved development of the MUSCL scheme for shock capturing as well as development of the spectral difference method for moving and deforming unstructured grids.

Education

2011-2017 **The George Washington University**, Washington, DC
PhD, Mechanical and Aerospace Engineering
Dissertation: *Development of a High-order Navier-Stokes Solver using Flux Reconstruction to Simulate Three-dimensional Vortex Structures in a Curved Artery Model*

2003-2005 **Stanford University**, Stanford, CA
MS, Aeronautics and Astronautics

1998-2003 **Rensselaer Polytechnic Institute**, Troy, NY
BS, Dual Aeronautical and Mechanical Engineering

Awards & Honors

2011-2017 The George Washington University Presidential Merit Fellowship
2016-2017 The George Washington University Douglas L. Jones Endowed Scholarship
2015 The George Washington University Graduate Research Theoretical Award, 1st Place
2013 ASME Pressure Vessel and Piping Outstanding Technical Paper for Fluid-Structure Interaction

2003-2005	Stanford University Graduate Federal Research Assistantship Award
1998-2003	Rensselaer Polytechnic Institute Donald V. Edwards Endowed Engineering Scholarship
1998-2003	Rensselaer Polytechnic Institute Dean's Scholarship
2000	Sigma Gamma Tau National Aerospace Engineering Honor Society
2000	Pi Tau Sigma International Mechanical Engineering Honor Society

Academic Positions

2011-2017 **The George Washington University**, Washington, DC
Graduate Research Assistant
Computational Aerodynamics and Hydrodynamics Laboratory
Biofluid Dynamics Laboratory
Advisers: Michael W. Plesniak, Chunlei Liang
Research: *Development of unstructured high-order numerical methods*

2005-2006 **Stanford University**, Stanford, CA
Research and Development Engineer
Hansen Experimental Physics Laboratory
Adviser: Rodney Torii
Research: *Satellite test of the Equivalence Principle*

2003-2005 **Stanford University**, Stanford, CA
Graduate Research Assistant
Hansen Experimental Physics Laboratory
Adviser: Rodney Torii
Research: *Satellite test of the Equivalence Principle*

2002 **Rensselaer Polytechnic Institute**, Troy, NY
Undergraduate Research Assistant
Experimental Fluid Mechanics Laboratory
Adviser: Amir H. Hirsa
Research: *Capillary micro-switches*

Teaching Experience

The George Washington University, Washington, DC
Teaching Assistant

F2013, F2016	MAE 3126 (undergraduate) - *Fluid Mechanics I*
F2014	APSC 6213 (graduate) - *Partial Differential Equations*
S2014	APSC 6212 (graduate) - *Linear Algebra*

Journal Articles

1. **C. Cox**, C. Liang and M.W. Plesniak, “A High-order Solver for Unsteady Incompressible Navier-Stokes Equations using the Flux Reconstruction Method on Unstructured Grids with Implicit Dual Time Stepping,” *Journal of Computational Physics*, Vol 314, pp 414-435, June 1, 2016.

2. C. Liang, **C. Cox** and M.W. Plesniak, “A Comparison of Computational Efficiencies of Spectral Difference Method and Correction Procedure via Reconstruction,” *Journal of Computational Physics*, Vol 239, pp 138-146, April 15, 2013.

Conference Articles and Presentations (refereed)

1. **C. Cox**, C. Liang and M.W. Plesniak, “A Flux Reconstruction Solver for Unsteady Incompressible Viscous Flow using Artificial Compressibility with Implicit Dual Time Stepping,” AIAA SciTech 54th Aerospace Sciences Meeting, January 4-8, 2016, San Diego, CA.

2. **C. Cox**, C. Liang and M.W. Plesniak, "A High-order Method for Solving Unsteady Incompressible Navier-Stokes Equations with Implicit Time Stepping on Unstructured Grids," AIAA SciTech 53rd Aerospace Sciences Meeting, January 5-9, 2015, Kissimmee, FL.

3. **C. Cox**, C. Liang and M.W. Plesniak, "Spectral Difference Solution of Incompressible Flow over an Inline Tube Bundle with Oscillating Cylinder," ASME 2012 Pressure Vessels and Piping Conference, July 15-19, 2012, Toronto, ON, Canada.
   Awarded the Outstanding Technical Paper for Fluid-Structure Interaction

Conference Abstracts and Presentations (non-refereed)

1. **C. Cox**, C. Liang and M.W. Plesniak, “Correlation between Vortices and Wall Shear Stress in a Curved Artery Model under Pulsatile Flow Conditions,” APS Division of Fluid Dynamics 70th Annual Meeting, November 19-21, 2017, Denver, CO.

2. **C. Cox**, C. Liang and M.W. Plesniak, “High-order Numerical Simulations of Pulsatile Flow in a Curved Artery Model,” APS Division of Fluid Dynamics 69th Annual Meeting, November 20-22, 2016, Portland, OR.

3. **C. Cox**, C. Liang and M.W. Plesniak, “A High-order Solver for Unsteady Incompressible Navier-Stokes Equations using the Flux Reconstruction Method,” APS Division of Fluid Dynamics 68th Annual Meeting, November 22-24, 2015, Boston, MA.

4. **C. Cox**, C. Liang and M.W. Plesniak, “Development of a Parallel High-order Solver with Flux Reconstruction for the Incompressible Navier-Stokes Equations,” AIAA Young Professional, Student and Education Conference, November 13, 2015, JHU Applied Physics Laboratory, MD.

5. **C. Cox**, C. Liang and M.W. Plesniak, "A Parallel 3D High-order Solver for Unsteady Incompressible Navier-Stokes Equations using Flux Reconstruction on Unstructured Grids," 13th U.S. National Congress on Computational Mechanics, July 26-30, 2015, San Diego, CA.

6. C. Liang, **C. Cox** and M.W. Plesniak, "A High-order Compact Spectral Difference Method for Unsteady Incompressible Flow," 5th International Conference on Scientific Computing and Partial Differential Equations, December 8-12, 2014, Kowloon Tong, Hong Kong.

7. **C. Cox**, C. Liang and M.W. Plesniak, "A Compact High-order Unstructured Method for Unsteady Incompressible Flow," APS Division of Fluid Dynamics 67th Annual Meeting, November 23-25, 2014, San Francisco, CA.

8. C. Mehls, D. Gill, **C. Cox**, N. Vora, D. Stricker, E. Berglund, P. Ambekar, R. Torii and S. Wang, "Effect of Surface Roughness on Critical Current of Niobium Films," AIP 24th International Conference on Low Temperature Physics, Vol 850, pp 991-992, September 7, 2006.

9. C. Mehls, C. Bayart, J. Bower, B. Clarke, **C. Cox**, D. Gill, D. Stricker, N. Vora, S. Wang, P. Zhou, R. Torii, P. Worden, D. Debra, H. Dittus and F. Loeffler, "STEP Prototype Development Status," The 11th Marcel Grossmann Meeting, On Recent Developments in Theoretical and Experimental General Relativity, Gravitation and Relativistic Field Theories, pp 2553-2555, July 23-29, 2006.

10. M. Vogel, P. Steen, A. Bhandar, A. Hirsa, **C. Cox** and C. Matalanis, "Bubbles and Beetles: Applications of Capillary Stability," The 1000 Islands Fluid Mechanics Meeting, May 9-11, 2003, Gannanoque, ON, Canada.

11. P. Steen, C. Matalanis, A. Hirsa and **C. Cox**, "Capillary Micro-Switches," APS Division of Fluid Dynamics 55th Annual Meeting, November 24-26, 2002, Austin, TX.

Poster Presentations

1. **C. Cox**, C. Liang and M.W. Plesniak, "Development of a Parallel 3D High-order Navier-Stokes Solver for Studying Secondary Flow Structures in a Curved Artery Model," The George Washington University Research and Development Competition, February 24, 2016.

2. **C. Cox**, C. Liang and M.W. Plesniak, "Development of a Fast Algorithm for Solving the Unsteady Incompressible Navier-Stokes Equations," The George Washington University Research and Development Competition, February 18-19, 2015.

3. **C. Cox**, C. Liang and M.W. Plesniak, "Development of a High-order Incompressible Flow Solver with Implicit Time Stepping," The George Washington University Research and Development Competition, February 19, 2014.

4. **C. Cox**, C. Liang and M.W. Plesniak, "High-order Numerical Simulations of Incompressible Flow using Correction Procedure via Reconstruction," The George Washington University Research and Development Competition, February 20, 2013.

5. **C. Cox**, C. Liang and M.W. Plesniak, “An Implicit Time Marching Scheme for Shock Capturing with MUSCL Reconstruction,” The George Washington University Research and Development Competition, February 29, 2012.

Industry Positions

2008-2010 **McGowan Investors**, Philadelphia, PA
Quantitative Research Analyst
Equity / Index Volatility Modeling for Option Pricing

2006-2008 **Volare Capital Management**, Philadelphia, PA
Quantitative Research Analyst
Equity / Index Volatility Modeling for Option Pricing

2001 **Pratt & Whitney – United Technologies Corporation**, East Hartford, CT
Design and Project Engineering Co-op
Hollow Fan Blades Department

Professional Activities

Peer Reviewer, Journal of Computational Physics
Peer Reviewer, Journal of Computers & Fluids
Peer Reviewer, AIAA Aerospace Sience Meeting
Peer Reviewer, AIAA Aviation
Member, American Institute of Aeronautics and Astronautics
Member, American Physical Society
Session Chair, ASME Pressure Vessels and Piping Conference, 2012
Abstract/Poster Judge, The George Washington University SEAS R&D Showcase, 2018