

Shaun Harris — Mechanical Engr.

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Education

Stanford University

Ph.D. Mechanical Engineering, GPA – 3.72

Stanford, CA

June 2022

- Concentration in Fluid Mechanics [R2]

Stanford University

M.S. Mechanical Engineering, GPA – 3.7

Stanford, CA

Apr 2018

- Depth in Fluid Mechanics

Utah State University (USU)

B.S. Mechanical Engineering, GPA – 3.95

Logan, UT

May 2016

- Summa Cum Laude
- Emphasis: Aerospace
- Minors: Management and Mathematics

Utah State University

A.S. General Studies, GPA – 4.0

Logan, UT

Aug 2010

Experience

Sandia National Laboratories

R&D Aeronautical Engineer

Albuquerque, NM

02/24 – present

- Conducted ensemble of linear stability analysis and trained reduced order model with uncertainty bounds to approximate the transition onset for a hypersonic vehicle design [C1]
- Simulated multitudes of aerothermal analysis to approximate time to demise for certain hypersonic vehicle damage at various flight conditions
- Maintained DOE-Q clearance

Sandia National Laboratories

Post-doctoral Research

Albuquerque, NM

06/22 – 02/24

- Analyzed direct numerical simulations and optimal linear studies for complex hypersonic geometries relevant to laminar-turbulent transition.[CP1, CP3]
- Formulated reduced order model with uncertainty bounds for transition onset for hypersonic vehicle design using an ensemble of linear stability theory predictions
- Coordinated incompressible flow stability analysis and model development [C2, R1]
- Maintained DOE-Q clearance

Sandia National Laboratories

Graduate Research Year-Round Intern

Albuquerque, NM

06/19 – 06/22

- Performed direct numerical simulations using massively parallel computer clusters for compressible high Reynolds number flows and compared to stability analysis for transition modeling [CP2]
- Implemented new boundary condition in massively parallel code architecture using C++
- Obtained and maintained DOE-Q clearance since Jan. 2021

Center for Turbulence Research

Graduate Research Student

Stanford, CA

01/18 – 06/22

- Developed reduced order model to study instabilities by using the Orr-Sommerfeld-Squire and the parabolized stability equations for study in laminar, transitional, and turbulent fluid flows [C4, R4, R7, CP4, C5, C7, R8]
- Applied machine learning for study and prediction of peak events in turbulent flow [R6]
- Aided in development of new wall model for LES in prediction of laminar-turbulent transition flow [R3]

Sandia National Laboratories

Livermore, CA

Graduate Research Summer Intern

06/18 – 09/18

- Simulated computational fluid dynamics of multi-component repair garage for hydrogen fuel cell vehicle failure analysis [A1, R5, C6]
- Created all simulation inputs from scratch and performed refinement/parameter studies

Flow Physics and Computation Engineering

Stanford, CA

Graduate Research Student

09/16–11/17

- Combined LES modeling with weather forecasting data assimilation techniques to enrich scales of LES models using experimental data from high-fidelity 3D PIV system [A2, C9]

Sandia National Laboratories

Albuquerque, NM

Technical Undergraduate Year-Round Intern

05/15 – 08/16

- Performed uncertainty quantification, verification, and validation of computation model of thermal batteries [R9, CP6]

High Performance Computational Fluid Dynamics Lab (USU)

Logan, UT

Undergraduate Computational Fluid Dynamics (CFD) Researcher

05/14 – 04/16

- Coded, as part of a team, parts of a CFD strand code (C++ and Fortran) [A3, CP5, CP7]

Experimental Fluid Dynamics Lab (USU)

Logan, UT

Undergraduate Research and Creative Opportunities Grant Recipient

1/14 – 12/14

- Led research and conducted experiment in olive oil tracer particle atomization [C10]

Experimental Fluid Dynamics Lab (USU)

Logan, UT

Undergraduate Research Assistant

12/12 – 03/14

- Assisted CFD validation experiments for safety analysis of nuclear reactors
- Designed and assembled various parts for particle image velocimetry (PIV) experiment

Synthetic Biomanufacturing Center (USU)

Logan, UT

Undergraduate Research Assistant

06/10 – 12/10

- Experimental phase of cohabitating two species in growth reactor for effective bio-diesel algae production
- Presented research finding to professors at conclusion of summer research

Awards

Fall 2016: Stanford Graduate Engineering Fellowship Award

Undergraduate Awards: Academic Excellence Senior (2016), Outstanding Undergraduate Researcher (2015), A-pin award (2014), Outstanding Pre-Professional Award (2014)

Undergraduate Scholarships: George S. & Dolores Doré Eccles Foundation University, Integrated University Program, USU Presidential, and New Century

Spring 2010: High School Salutatorian of 453 students

Skills

Coding: Python, C++, MatLab, Fortran, batch scripts for HPC, LabVIEW, and Vim

Software: ParaView, CUBIT, tecplot, Pointwise, Solid Works, and Solid Edge

Written: Microsoft Office, L^AT_EX, and \approx 90 WPM

Technical: hand tools, saws, mills, drill presses, and soldering

Biological: autoclave, optical density machine, centrifuge, flow hoods, and pipettes

Leadership and Volunteer

03/23 – **Current:** Journal of Fluid Mechanics Reviewer

01/20 – **Current:** Member of the American Institute of Aeronautics and Astronautics (AIAA)

01/15 – **Current:** Member of the Tau Beta Pi Society

01/14 – 12/17: Member of the American Nuclear Society (ANS)

- Communications Officer (ANS) USU section

01/13 – 11/13: Member of the American Society of Mechanical Engineers (ASME)

01/11 – 12/12: Full-time Service Volunteer for non-profit organization in Atlantic Canada

- Leader over fellow volunteers in door-to-door communications
- Trained and instructed fellow volunteers in presentation effectiveness
- Worked with people providing addiction recovery and life coaching

2008: Eagle Scout

Articles

- [A1] B. D. Ehrhart et al. “Risk assessment and ventilation modeling for hydrogen releases in vehicle repair garages”. In: *International Journal of Hydrogen Energy* 46 (23 2021), pp. 12429–12438. doi: 10.1016/j.ijhydene.2020.09.155.
- [A2] J. W. Labahn et al. “Ensemble Kalman Filter for Assimilating Experimental Data into Large-Eddy Simulations of Turbulent Flows”. In: *Flow, Turbulence and Combustion* (2019). issn: 15731987. doi: 10.1007/s10494-019-00093-1.
- [A3] O. Tong et al. “High-Order Strand Grid Methods for Shock Turbulence Interaction”. In: *International Journal of Computational Fluid Dynamics* 32.4-5 (2018), pp. 203–217. doi: 10.1080/10618562.2018.1490411.

Reports

- [R1] C. A. Gonzalez, S. R. Harris, and P. Moin. *Simulating an H-type transitional boundary layer in a coupled NLPSE and WMLES framework with a Falkner-Skan wall model*. Center for Turbulence Research, 2023.
- [R2] Shaun Harris. “Some numerical considerations for prediction of laminar-turbulent transition in boundary layers”. PhD thesis. Stanford University, 2022. URL: <https://purl.stanford.edu/hb041ct1379>.
- [R3] C. A. Gonzalez, S. R. Harris, and P. Moin. *Falkner-Skan wall model baseflow generation for the parabolized stability equations*. Center for Turbulence Research, 2021.
- [R4] S. R. Harris, P. Moin, and M. J. P. Hack. *Predicting the nonlinear amplification of disturbances using the spatial perturbation equations in a viscous boundary layer*. Center for Turbulence Research, 2021.
- [R5] B. D. Ehrhart et al. *Risk Assessment and Ventilation Modeling for Hydrogen Release in Vehicle Repair Garages*. English. Tech. rep. Sponsor Org.: USDOE National Nuclear Security Administration (NNSA). United States, 2020. URL: <https://www.osti.gov/servlets/purl/1617120>.
- [R6] S. R. Harris and M. J. P. Hack. *Forecasting extreme dissipation events in wall turbulence using machine learning*. Annual Research Brief. Center for Turbulence Research, 2020. URL: http://web.stanford.edu/group/ctr/ResBriefs/2020/21_Harris.pdf.
- [R7] S. R. Harris and M. J. P. Hack. *Well-posed marching of disturbances using the spatial perturbation equations*. Annual Research Brief. Center for Turbulence Research, 2020. URL: http://web.stanford.edu/group/ctr/ResBriefs/2020/24_Harris.pdf.

- [R8] S. R. Harris and M. J. P. Hack. *Well-posed spatial marching of perturbations in viscous shear flows*. Annual Research Brief. Center for Turbulence Research, 2019. URL: http://web.stanford.edu/group/ctr/ResBriefs/2019/08_Harris.pdf.
- [R9] S. A. Roberts et al. *Establishing the Credibility of the Thermally Activated Battery Simulator, Full-Battery Version 4: Verification, Validation, and Uncertainty Quantification*. Sandia Report SAND2017-3397. Sandia National Laboratories, 2017.

Conference Papers

- [CP1] **S. R. Harris** and R. Wagnild. "Numerical considerations of slow acoustic mode in high-velocity boundary layers". In: *AIAA SciTech 2023 Forum*. doi: 10.2514/6.2023-1236.
- [CP2] **S. R. Harris** and R. Wagnild. "Second mode growth in a high-velocity boundary layer using stability theory and DNS". In: *AIAA Aviation 2021 Forum*. doi: 10.2514/6.2021-2845.
- [CP3] **R. Wagnild** et al. "DNS of a Mach 14 Flow Over a Sharp Cone in AEDC Tunnel 9". In: *AIAA SciTech 2023 Forum*. doi: 10.2514/6.2023-0866.
- [CP4] **S. R. Harris** and M. J. P. Hack. "Well-posed spatial marching of high-amplitude perturbations in viscous shear flows". In: *AIAA SciTech 2020 Forum*. Jan. 2020. doi: 10.2514/6.2020-0829.
- [CP5] **O. Tong** et al. "Asymptotic Geometry Representation for Complex Configurations on Strand Grids". In: *AIAA SciTech*. Jan. 2016. doi: 10.2514/6.2016-1584.
- [CP6] **B. Trembacki** et al. "Uncertainty Quantification, Verification, and Validation of a Thermal Simulation Tool for Molten Salt Batteries". In: *47th Power Sources Conference, Orlando FL*. 2016. URL: <https://www.osti.gov/servlets/purl/1365182>.
- [CP7] **O. Tong** et al. "High-Order Strand Grid Methods for Shock Turbulence Interaction". In: *22nd AIAA Computational Fluid Dynamics Conference*. 2015. doi: 10.2514/6.2015-2283.

Conferences

- [C1] S. Harris and R. Wagnild. "Laminar-Turbulent Transition Prediction for Hypersonic Vehicles Using Reduced Order Models Derived From Parabolized Stability Equations". In: *AIAA Defense Forum*. 2024.
- [C2] **C. Gonzalez** and S. Harris. "Simulating an H-type transitional boundary layer in a coupled NLPSE and WMLES framework with a Falkner-Skan wall model". In: *76th Annual Meeting of the APS Division of Fluid Dynamics*. 2023. URL: <https://meetings.aps.org/Meeting/DFD23/Session/J12.8>.
- [C3] **C. A. Gonzalez** et al. "Reduced-order Modeling of Laminar Boundary Layers". In: *74th Annual Meeting of the APS Division of Fluid Dynamics*. Nov. 2021. URL: <https://meetings.aps.org/Meeting/DFD21/Session/M08.6>.
- [C4] **S. R. Harris**, M. J. P. Hack, and P. Moin. "Predicting the nonlinear amplification of disturbances using the Spatial Perturbation Equations in a viscous boundary layer". In: *74th Annual Meeting of the APS Division of Fluid Dynamics*. Nov. 2021. URL: <https://meetings.aps.org/Meeting/DFD21/Session/T03.2>.
- [C5] **S. R. Harris**, M. J. P. Hack, and P. Moin. "Modeling the amplification of disturbances using the Spatial Perturbation Equations". In: *73rd Annual Meeting of the APS Division of Fluid Dynamics*. Nov. 2020. URL: <https://meetings.aps.org/Meeting/DFD20/Session/H05.8>.
- [C6] **B. D. Ehrhart** et al. "Risk assessment and ventilation modeling for hydrogen vehicle repair garages". In: *International Conference on Hydrogen Safety*. 2019. URL: https://hysafe.info/myfiles/ichs2019/ICHS_2019_Program.pdf.

- [C7] **S. R. Harris** and M. J. P. Hack. “Nonlinear spatial marching of high-amplitude perturbations”. In: *72nd Annual Meeting of the APS Division of Fluid Dynamics*. 2019. URL: <http://meetings.aps.org/Meeting/DFD19/Session/P33.6>.
- [C8] **J. Labahn** et al. “The application of data assimilation to combine experimental data and LES for improved state-estimation”. In: *71st Annual Meeting of the APS Division of Fluid Dynamics*. 2018. URL: <https://meetings.aps.org/Meeting/DFD18/Session/D31.10>.
- [C9] **S. R. Harris**, J. Labahn, and M. Ihme. “The coupling of high-speed high resolution experimental data and LES through data assimilation techniques”. In: *70th Annual Meeting of the APS Division of Fluid Dynamics*. 2017. URL: <http://meetings.aps.org/Meeting/DFD17/Session/L28.11>.
- [C10] **S. R. Harris** and B. Smith. “Olive Oil Tracer Particle Size Analysis for Optical Flow Investigations in a Gas Medium”. In: *67th Annual Meeting of the APS Division of Fluid Dynamics*. 2014. URL: <http://meetings.aps.org/link/BAPS.2014.DFD.R29.9>.