Madison Sheridan

Curriculum Vitae

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Research Interests

Numerical methods for PDEs, Hyperbolic systems of conservation laws, Computational fluid dynamics, Compressible Euler equations, Lagrangian hydrodynamics.

Education

2019–2025 **PhD, Mathematics**, *Texas A&M University*, College Station, TX.
Thesis: A Robust Lagrangian Framework for Compressible Flow & Hyperelasticity

2015–2019 **Bachelor of Science, Mathematics (Computer Science minor)**, *Brigham Young University – Idaho*, Rexburg, ID.

Experience

2019–2025 **Graduate Teaching/Research Assistant**, *Texas A&M University*, College Station, TX.
Advisor: Jean-Luc Guermond

- Developed a finite element method for the equations of Lagrangian hydrodynamics that achieves high-order accuracy while preserving essential physical invariants, ensuring robustness in challenging flow regimes.

- Collaborated across mathematics, physics, and engineering teams; presented findings at SIAM CSE, USNCCM, and other national conferences.

- Served as Instructor of Record for Math 140, independently leading classroom instruction, developing assignments and exams, and evaluating student performance.

2022–2023 **Graduate Student Intern**, *Lawrence Livermore National Laboratory*, Livermore, CA.
Mentor: Vladimir Tomov

- Augmented high-order Lagrangian hydrodynamics codes in C++/MFEM with an invariant-domain preserving Lagrangian finite element method, ensuring physics-consistent robustness validated with benchmark tests.

- Modified an MFEM discontinuous Galerkin advection solver for use with continuous finite element discretizations, extending code capabilities and supporting broader benchmarking.

2019–2022   **Graduate Student Intern**, *Nevada National Security Site*, North Las Vegas, NV.
Mentors: Cleat Zeiler, Marylesa Howard, Daniel Champion, Jesse Adams

- Developed and trained deep learning models in Python/TensorFlow to reconstruct clipped seismic waveforms, improving signal fidelity and enabling more accurate seismic event detection.
- Designed a Python-based multilateration algorithm using geophone array data to geolocate seismic signal sources with improved accuracy, supporting rapid deployment for field missions.

Publications

2025   Guermond, J.-L., Popov, B., Saavedra, L., Sheridan, M., *"Invariant-domain-preserving and locally mass conservative approximation of the Lagrangian hydrodynamics equations,"* Computer Methods in Applied Mechanics and Engineering

Talks

2025   *A Robust Lagrangian Framework for Compressible Flow & Hyperelasticity*, Dissertation Defense, Texas A&M University, College Station, TX, USA. October 2025.

2025   *A Robust Lagrangian Framework for Compressible Flow & Hyperelasticity*, Mathematics Graduate Student Organization Seminar, Texas A&M University, College Station, TX, USA. September 2025.

2025   *Invariant-Domain-Preserving Approximation of the Lagrangian Hydrodynamics Equations*, LANL Center for Nonlinear Studies Seminar Series, Los Alamos, NM, USA. September 2025.

2024   *Invariant-Domain-Preserving and Exactly Conservative Approximation of the Lagrangian Hydrodynamics Equations*, 7th Annual Meeting of the SIAM Texas-Louisiana Section, Baylor University, Waco, TX, USA. October 2024.

2024   *Invariant-Domain-Preserving and Exactly Conservative Approximation of the Lagrangian Hydrodynamics Equations*, Second annual RTG NASC Annual Workshop, Rice University, Houston, TX, USA. October 2024.

2023   *Invariant-Domain-Preserving and Exactly Conservative Approximation of the Lagrangian Hydrodynamics Equations*, 6th Annual Meeting of the SIAM Texas-Louisiana Section, University of Louisiana at Lafayette, Lafayette, LA, USA. November 2023.

2023   *A Brief Introduction to Finite Element Methods*, Applied Mathematics Undergraduate SEminar (AMUSE), Texas A&M University, College Station, TX, USA. October 2023.

2023   *Invariant-Domain-Preserving and Exactly Conservative Approximation of the Lagrangian Hydrodynamics Equations*, Intern Final Presentations, Livermore, CA, USA. August 2023.

2023   *Invariant-Domain-Preserving and Exactly Conservative Approximation of the Lagrangian Hydrodynamics Equations*, 17th U. S. National Congress on Computational Mechanics, Albuquerque, NM, USA. July 2023.

2023	*Invariant-Domain-Preserving and Exactly Conservative Approximation of the Lagrangian Hydrodynamics Equations*, Finite Element Rodeo, Texas A&M University, College Station, TX, USA. March 2023.
2023	*Invariant-Domain-Preserving and Exactly Conservative Approximation of the Lagrangian Hydrodynamics Equations*, SIAM Conference on Computational Science and Engineering (CSE23), Amsterdam, The Netherlands. February 2023.
2022	*Invariant Domains and a First-Order Continuous Finite Element Approximation*, Intern Final Presentations, Livermore, CA, USA. August 2022.
2021	*Invariant Domain Preserving IMEX Methods*, SIAM TX-LA Meeting, University of Texas Rio Grande Valley, South Padre Island, TX, USA. November 2021.

Posters

2025	*Invariant-Domain-Preserving and Exactly Conservative Approximation of the Lagrangian Hydrodynamics Equations*, Hypersonics Workshop, College Station, TX, USA. August 2025.
2023	*Invariant-Domain-Preserving and Exactly Conservative Approximation of the Lagrangian Hydrodynamics Equations*, Intern Poster Presentations, Livermore, CA, USA. August 2023.
2023	*Invariant-Domain-Preserving and Exactly Conservative Approximation of the Lagrangian Hydrodynamics Equations*, 7th KUMUNU-ISU Conference in PDE, Dynamical Systems and Applications, Iowa State University, Aimes, IA, USA. April 2023.
2019	*Seismic Clipped Waveform Reconstruction and Noise Attenuation Using Deep Learning*, American Geophysical Union Fall Meeting, San Francisco, CA, USA. December 2019.

Leadership

2023	**Organizer**, *Mini-symposium on "Invariant-Domain Preserving Hydrodynamics: From Euler to Navier-Stokes"*, 17th U. S. National Congress on Computational Mechanics, July 2023.
2022	**Organizer**, *Mini-symposium on "High Order Methods for Computational Hydrodynamics"*, 5th Annual Meeting of the SIAM Texas-Louisiana Section (TXLA22), November 2022.
2019–2024	**President, Vice President, Treasurer**, *Society for Industrial and Applied Math Graduate Student Chapter, Texas A&M University*.

Software development

2021–Present	**MFEM**, *LLNL*, Scalable C++ library for finite element methods.

Outreach/Mentorship

2024	**Mentor**, Advised an undergraduate research project on nonlinear elasticity for the Modeling and Simulation with PDEs summer school, Texas A&M University

2023	**Volunteer**, Mathematics and Statistics Fair, Texas A&M University
2022	**Mentor**, Advised an undergraduate research project studying chemotaxis for the Directed Reading Program, Texas A&M University
2021–2022	**GED Prep Instructor**, B/CS Community Education Center, Bryan, TX
2019	**Proctor**, High School Math Contest, Texas A&M University
2011	**Eagle Scout**, El Dorado Hills, CA.

Membership

American Mathematical Society (AMS)

Society for Industrial and Applied Mathematics (SIAM)

Computer Languages

Proficient in: C++, Python, LaTeX, Git, Lisp, Mathematica

Knowledgeable in: Java, JavaScript, Fortran2003, Matlab

Languages

English	Native Language
Portuguese	Intermediate Listener, Intermediate Speaker, Advanced Reader, Novice Writer