

Seth Gerberding

PH.D. MATHEMATICS

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Professional Profile

Applied mathematician specializing in numerical analysis, verification and validation, uncertainty quantification, and high-performance scientific computing. Extensive experience developing and verifying high-order computational methods for partial differential equations, including matrix-free finite element solvers, large-scale simulation workflows, and validation against experimental data. Strong programming background in C++, Python, MPI, and scientific software frameworks, with proven success translating mathematical theory into robust computational tools for national-lab and engineering applications.

Education

Texas A&M University

PH.D. IN MATHEMATICS: ADVISED BY DR. JEAN-LUC GUERMOND

[College Station, TX](#)

August 2026

University of South Dakota

BACHELOR OF SCIENCE IN MATHEMATICS AND PHILOSOPHY, *Summa Cum Laude*
Honors Program University Scholar, Pi Mu Epsilon

[Vermillion, SD](#)

May 2020

Research Experience

Graduate Research Assistant (Mentors: Jeff Peterson & Jim Ferguson)

[Los Alamos, NM](#)

LOS ALAMOS NATIONAL LABORATORY (LANL)

October 2023- Present

- Developed verification methods for simulations using an arbitrary equation of state.
- Implemented a python program that computes a semi-analytic solution that is agnostic to the equation of state; code was integrated into the *ExactPack* software library.
- Applied the method to verify the *singularity-eos* equation of state library developed by LANL.
- Results were compiled in a technical report and published in a peer-reviewed journal (see publications below).

Graduate Assistant Research (funded by Dr. Jean-Luc Guermond)

[College Station, TX](#)

TEXAS A&M UNIVERSITY

October 2022- Present

- Developed and implemented robust finite element methods for dispersive partial differential equations.
- Mathematically proved the numerical algorithms are robust, meaning they satisfy key properties such as energy/energy stability and invariant-domain preservation.
- Developed a robust, high-order finite element method for generalized Korteweg de-Vries equations. Included development of a stand-alone low-order deal.II code and implementation of a high-order version in deal.II (see programming and coding below).
- Developed a robust, high-order finite element method for the Serre-Green-Naghdi shallow water equations. Method was certifiably robust, meaning proved mathematically that the method provably satisfied key properties.
- Conducted solution verification and validation testing, including comparing different models to experimental data to evaluate the models' validity.
- Attended multiple conferences to communicate new research with the broader applied mathematics and engineering community (see presentations below).
- Authored academic journals and published in peer-reviewed journals (see publications below).

Summer Fellow, XCP Computational Physics Workshop (Mentors: Jeff Peterson, Daniel Holladay, and Eric Tovar)

[Los Alamos, NM](#)

LOS ALAMOS NATIONAL LABORATORY (LANL)

June 2023- August 2023

- Developed analytic solutions for special cases of the Euler equations.
- Wrote Python code to analyze and plot the solution.
- Ran problems using the Eulerian code, xRAGE.
- Results were compiled in an internal LANL report (see publications below).

Student Intern (Mentor: Matthew Farthing, Senior Research Scientist)

[Vicksburg, MS](#)

UNITED STATES ARMY CORPS OF ENGINEERS

May 2022- May 2023

- Developed an implicit-explicit (IMEX) finite element method for the linear Korteweg-De Vries (KdV) equation.
- Implemented method using python.
- Wrote a report detailing the method and numerical results.

Undergraduate mathematics researcher (Mentor: Dr. Anne Shiu)

College Station, TX

TEXAS A&M UNIVERSITY

May 2019 - July 2019

- One of four undergraduates selected through competitive application process. Awarded \$4,400 to conduct new research in the area of computational biology.
- Proved three significant theorems.
- Wrote a twenty-six-page report on the findings in LaTeX.
- Results published in peer-review journal (see publications below).

UDiscover Scholar (Mentor: Dr. Catalin Georgescu)

Vermillion, SD

USD CENTER FOR ACADEMIC AND GLOBAL ENGAGEMENT

May 2018 - August 2018

- One of eight undergraduates selected through competitive, application-interview process. Awarded \$3,000 to conduct new research and creative scholarship.
- Developed MAPLE code for numerical experiments.
- Proved two significant theorems.

Programming and Coding

Programming Languages: C++, Python, MATLAB

Scientific Computing: deal.II, MPI, Numpy, SciPy, PETSc

Visualization and Post-processing: ParaView, Matplotlib, Tikz, pgfplots

Development Tools: Git, GitHub, Linux/Unix, CMake, VS Code, Vim/Neovim

Notable Repositories & Contributions:

Ryujin (github.com/conservation-laws/ryujin): Implemented finite element methods for generalized Korteweg de-Vries equations and Serre-Green-Naghdi shallow water equations. Implementations included high-order time-stepping algorithms, matrix-free geometric multi-grid frameworks for linear algebra solvers, and parallel capabilities (vectorization, MPI). Also included verification and validation test problems to verify and validate the numerical models.

ExactPack (github.com/lanl/ExactPack): Implemented a modular semi-analytic solution constructor for the Noh problem that is agnostic to the equation of state and other initial conditions and model parameters. Included an equation of state (EoS) library so users can choose their EoS to verify. Library included a wrapper for the *singularity-eos* library, allowing the use of tabulated equations of state (based on the work in “Semi-analytic solutions to the Noh problem with a black box EoS”, see below).

Certificates

DillerDigital Software Engineering in the Age of AI. June 2026. Learned “how to use source control, tests, interfaces, documentation, logging, profiling, debugging, and code review to maintain accountability and confidence in software produced through human-led, collaborative, or agentic workflows” over a 4-day class.

Service

Texas A&M Strategic Budgeting Council

Texas A&M University

GRADUATE STUDENT REPRESENTATIVE

October 2025-June 2026

- Advocated for graduate and professional students in the university’s budgeting process.
- Appointed by the Graduate and Professional Student Government President.
- Worked with the university president, provost, CFO, vice president of finance, and other top university leaders to craft recommendations for the university’s multi-billion dollar budget.
- Secured \$1.85 million dollars in funding for graduate student stipends and support.

Graduate and Professional Student Government

Texas A & M University

PARLIAMENTARIAN

October 2025-present

- Advise student leaders on parliamentary procedure and the organization’s bylaws and constitution.
- Serve as the acting Speaker/Executive Vice President when the Speaker is unavailable.

SPEAKER AND EXECUTIVE VICE PRESIDENT

April 2024-April 2025

- Elected by the Graduate and Professional Student Senate.
- Led a rewriting of the organization's constitution and bylaws.
- Served as chair of Graduate and Professional Student Senate.
- Advocated on behalf of over 16,000 graduate and professional students at Texas A&M University.
- Assisted student senators in writing legislation.
- Crafted and disseminated meeting agendas.
- Doubled number of senators through a coordinated recruitment effort.
- Engaged with university, state, and federal leaders to improve the graduate and professional student experience.

SENATOR, DEPARTMENT OF MATHEMATICS

September 2023- April 2024

- Advocated for graduate and professional student interests in student government.
- Successfully wrote legislation for an election reform that allowed graduate student organizations more control in their elections. Legislation was overwhelmingly passed.
- Worked with a team of student leaders to organize a professional development seminar, setting the stage for a large annual event for graduate students.

Texas A&M SIAM (Society of Industrial and Applied Mathematics) Graduate Student Chapter

College Station, TX

LIAISON: MAY 2023-MAY 2024; PRESIDENT: MAY 2022 - MAY 2023; SECRETARY: MAY 2021- MAY 2022

May 2021 - Present

- Coordinated the Industrial and Applied Mathematics Seminar.
- Managed and updated the chapter website using html code.
- Organized and facilitated events for students and the mathematics department.

USD Council for Undergraduate and Creative Scholarship

Vermillion, SD

STUDENT REPRESENTATIVE

October 2018-May 2020

- One of three undergraduates selected to sit on council.
- Managed research opportunities for undergraduates.
- Member of the IdeaFest subcommittee to organize the annual undergraduate/graduate research symposium.

USD Math Club

Vermillion, SD

PRESIDENT, MAY 2018-2020 TREASURER SECRETARY, MAY 2017-MAY 2018

October 2018-May 2020

- Promoted mathematics and related sciences on campus by coordinating events and speakers.
- Brainstormed events to recruit new members.

Awards and Scholarships

The Aggie Core Values Award. 2026. Awarded by the Texas A&M University Graduate and Professional Student Government in recognition of a TAMU graduate or professional student that exemplifies the Aggie Spirit by "consistently displaying the characteristics that are the Aggie core values." The TAMU Association of Former Students sponsors a scholarship to the purchase of an Aggie Ring.

Association of Former Students Aggie Ring Scholarship. 2026. Awarded \$1,500 dollars from the TAMU Association of Former Students towards the purchase of an Aggie Ring.

Guseman Award. 2025. Awarded by the Texas A&M Graduate and Professional Student Government. Awarded "in recognition of outstanding contributions to the success and prosperity of the welfare of the Graduate and Professional Student Government, and to the graduate and professional student body at Texas A&M University."

30 Under 30, Class of 2023. 2023. Awarded by University of South Dakota Alumni Association. Awarded to young alumni who "are making an impact in their professional and personal lives. Alumni are recognized for academic & professional achievements, leadership and/or university engagement."

Thesis with High Distinction. 2020. Undergraduate award for outstanding honors thesis. Awarded by the USD Honors Committee (see publications below).

Eagle Scout. 2015. Highest rank granted by the Boy Scouts of America. Member for twelve years. Included hundreds of hours of community service.

Teaching Experience

PDE Summer School Assistant

College Station, TX

TEXAS A&M UNIVERSITY DEPARTMENT OF MATHEMATICS

May 2025 & May 2026

- Assisted with the execution of a two-week intensive summer-school for undergraduate students interested in modeling and scientific computing.
- With another graduate student, helped students implement a finite-difference method for the Maxwell equations.
- Taught key concepts such as code and solution verification, including the methods of exact and manufactured solutions.

Mentor for Directed Reading Program

College Station, TX

TEXAS A&M UNIVERSITY DEPARTMENT OF MATHEMATICS

Sept.-Dec. 2022, Sept.-Dec. 2024

- Mentored undergraduate students one-on-one through advanced mathematical textbooks. Crafted reading plans and exercises. Helped edit and rehearse slides to prepare students to present to their peers.
- First project included working one-on-one with two students on mathematical biology, specifically ODE population models. Project included implementing a finite-difference method to study a Lotka-Volterra model.
- Second project included working one-on-one with a talented undergraduate student on metric spaces. Developed a reading plan and exercises to strengthen the student's learning experience. Student crafted and presented slides to peers at the end of semester.

Teaching Assistant (Aggregate Experience)

College Station, TX

TEXAS A&M UNIVERSITY DEPARTMENT OF MATHEMATICS

August 2020 - May 2022

- Facilitated recitations and labs for Calculus I and Calculus II courses, managed grading and structured learning for over 100 students.
- Graded homework and quizzes for "Introduction to Proofs," "Combinatorics," and "Differential Equations."

Math Circle Facilitator

College Station, TX

TEXAS A&M UNIVERSITY

January 2021 - May 2021

- Facilitated problem solving sessions for gifted K-12 Students.
- Volunteered on weekends.

Tutor

Vermillion, SD

USD ACADEMIC AND CAREER PLANNING CENTER

January 2017 - May 2020

- Tutored students individually or in groups in courses ranging from pre-college Algebra, Differential Equations, Calculus 3, and logic, among others.
- Helped students develop effective study habits.
- Assisted in time management and study planning.

Other Relevant Experience

Student Ambassador

Vermillion, SD

USD OFFICE OF ADMISSIONS

May 2017-May 2020

- Conducted campus tours for prospective students.
- Facilitated efficient visit days by assisting visitors with directions, information, and support.
- Provided high-quality customer service by guiding prospective students and their families across campus.

Opinion Editor

Vermillion, SD

THE VOLANTE USD STUDENT NEWSPAPER

September 2017-May 2018

- Managed a collection of column writers, including editing six columns per week multiple times, brainstorming topics for columns, and providing feedback on edits and topics.
- Designed and produced opinion page using InDesign.

Congressional Intern

Washington, D.C.

SENATOR STEVE DAINES, WASHINGTON, D.C.

January 2016-May 2016

- Assisted staff members with various projects.
- Developed strong teamwork skill with members of the staff to complete projects as a team.

Congressional Intern

Washington, D.C.

SENATOR JOHN THUNE, WASHINGTON, D.C.

September 2015- December 2015

- Assisted staff members with various projects.
- Developed strong teamwork skill with members of the staff to complete projects as a team.

Publications

Peer-Reviewed

Gerberding, Seth, Jean-Luc Guermond. "A High-Order Implicit Explicit Approximation of the Serre-Green-Naghdi Equations." *In preparation*.

Gerberding, Seth, Jeff Peterson, Jim Ferguson, and Scott Ramsey. "Semi-analytic solutions to the Noh problem with a black box EoS." *Physics of Fluids* 1 January 2026; 38 (1): 016113

Gerberding, Seth. "A High Order IMEX Method for Generalized Korteweg de-Vries Equations." *Journal of Computational and Applied Mathematics* 475, (2026)

Gerberding, Seth, Nida Obatake, and Anne Shiu. "Identifiability of linear compartmental models: the effect of moving inputs, outputs, and leaks." *Linear and Multilinear Algebra* 70, no. 14 (2022): 2782-2803.

Technical Reports

Seth Gerberding. "Black Box Equations of State: Creating Semi-analytic Solutions to the Noh Problem and Verifying Equation of State Interfaces." Technical Report. Los Alamos National Laboratory, 2024. LA-UR-29056.

Seth Gerberding and Benjamin Musick. "Verification & Validation of a New Equation of State Framework in xRAGE." Technical Report. Los Alamos National Laboratory, 2023. LA-UR-23-29866.

Theses

Seth Gerberding. "A Robust Numerical Approximation of Dispersive Shallow Water Equations and Verification Technique Using a Black-Box EOS." Ph.D. Dissertation, Texas A&M University. 2026.

Seth Gerberding. "Plato's Ban: Why the Poets are Exiled." Bachelors Thesis, University of South Dakota, 2020. Awarded High Distinction.

Seth Gerberding. "Groups of Divisibility." Bachelors Thesis, University of South Dakota, 2020.

Presentations

Gerberding, S. A Robust IMEX Method for the Serre-Green-Naghdi Equations. Finite Element Rodeo, UT Austin, Austin, TX, February 2026.

Gerberding, S. Verification with a Black-Box Equation of State. AIAA SciTech, Orlando, Florida, January 2026.

Gerberding, S. A Robust IMEX Method for the Serre-Green-Naghdi Equations with Partial Topography. SIAM Geosciences, Louisiana State University, Baton Rouge, LA, October 2025.

Gerberding, S. A Robust IMEX Method for the Serre-Green-Naghdi Equations with Partial Topography. SIAM TX-LA Sectional, University of Texas at Austin, Austin, TX, September 2025.

Gerberding, S. Finite Element approximation of scalar dispersive PDEs. Finite Element Rodeo, Rice University, Houston, TX, 2024.

Gerberding, S. Verification: The Euler equations, the Noh Problem, and the mathematics behind reliable simulations in extreme conditions. University of South Dakota Department of Mathematics Seminar, Vermillion, SD, November 2023.

Gerberding, S. and Guermond, J.-L. Finite Element approximation of dispersive PDEs. SIAM TX-LA Sectional Meeting, Lafayette, LA, October 2023.

Gerberding, S. and Guermond, J.-L. Finite Element approximation of dispersive PDEs. USNCCM, Albuquerque, NW, July 2023.

Gerberding, S. IMEX Methods for third order PDEs. Finite Element Rodeo, College Station, TX, March 2023.

Gerberding, S. Preserving Identifiability in Linear Compartmental Models: Moving Leaks, Outputs, and Inputs. IdeaFest, Vermillion, SD, 2020.

Gerberding, S. Identifiability of linear compartmental models: The effect of moving inputs, outputs, and leaks. Joint Mathematics Meeting, Denver, CO, 2020.

Gerberding, S. Preserving Identifiability in Linear Compartmental Models by moving Leaks, Outputs, and Inputs. University of South Dakota Department of Mathematical Sciences Seminar Series, Vermillion, SD, 2019.

Gerberding, S. Plato's Dialectic. Upper Midwest Honors Conference, University of Wisconsin-Stout, WI, 2019.

Gerberding, S. Patterns Generated by Barycentric Subdivision of Triangles. Upper Midwest Honors Conference, University of Wisconsin-Stout, WI, 2019.

Gerberding, S. Plato and Freedom of Speech: Censorship protecting Truth. Minnesota Philosophical Society, Rochester, MN, 2018.

Posters

Gerberding, S. and Guermond, J.-L. Finite element approximation of dispersive PDEs. Time Integration Methods for Multi-Physics Applications, Los Alamos National Laboratory, NM, August 2023.

Gerberding, S. and Guermond, J.-L. A C^0 finite element method for dispersive PDEs. KUMUNU-ISU Conference in PDE, Dynamical systems, and Applications, Iowa State University, IA, April 2023.

Gerberding, S. Patterns Generated by Barycentric Subdivision of Triangles. Poster Presentation, IdeaFest, University of South Dakota, SD, 2019.

Gerberding, S. Patterns Generated by Barycentric Subdivision of Triangles. Poster Presentation, IdeaFest, University of South Dakota, SD, 2019.