Dept. of Applied Mathematics and Statistics, Colorado School of Mines
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Scott A. Strong

Research Interests

General Mathematical physics of vortex domainated flows in ultracold fluids

Specific Differential geometry of space curves in ambient Euclidean space, Asymptotic analysis of the Biot–Savart integral, nonlinear PDE with dispersive, dissipative and shock phenomenon, simulation of isolated vortex filaments, mathematical fluid dynamics

Appointments

2013–present **Teaching Professor**, *Department of Applied Mathematics and Statistics*, Colorado School of Mines.
- Director of Undergraduate Studies for AMS (2013–Present)

2010–2013 **Teaching Associate Professor**, *Department of Applied Mathematics and Statistics*, Colorado School of Mines.

2003–2010 **Instructor**, *Department of Mathematical and Computer Sciences*, Colorado School of Mines.

2001–2003 **Adjunct Instructor**, *Department of Mathematical and Computer Sciences*, Colorado School of Mines, Golden, CO.

Education

2007–2018 **Ph.D. in Applied Physics**, *Colorado School of Mines*, Golden, CO.

Dissertation *Geometric Quantum Hydrodynamics and Bose-Einstein Condensates : Non-Hamiltonian Evolution of Vortex Lines*

Committee Lincoln D. Carr (advisor), Junko Munakata Marr (chair), Paul A. Martin, David M. Wood

Topics Differential Geometry of Space Curves, Fluid Dynamics of Bose–Einstein Condensation, Nonlinear Partial Differential Equations, Non-Hamiltonian Models, Dissipative Solitons, Dispersive Shock Waves

2005–2006 **M.Sc. in Computational and Applied Mathematics**, *Colorado School of Mines*, Golden, CO.

Topics Real, Complex, Functional and Asymptotic Analysis, Numerical Linear Algebra and Differential Equations, Wave Modeling, Quantum Mechanics

1997-2001 **B.Sc. in Mathematical and Computer Sciences**, *Colorado School of Mines*, Golden, CO.

Topics Dynamical systems, parallel computing, algorithms, operating systems and software engineering

Project Implementation of CLAPAK eigenvalue routines for sparse matrices associated with vibrational modes of multi–component crystal lattices

Refereed Publications

1. **Strong, S. A.** and G. G. Greivel, "Context rich differential equations in the engineering core and scale-up without studios," in *2019 ASEE RMS Conference Proceedings* (2019)

2. G. G. Greivel and **Strong, S. A.**, "A scale-up instructional environment for multivariate calculus in the engineering core," in *2019 ASEE RMS Conference Proceedings* (2019)

3. S. A. Strong, *Geometric Quantum Hydrodynamics and Bose-Einstein Condensates: Non-Hamiltonian Evolution of Vortex Lines*, Ph.D. thesis, Colorado School of Mines (2018)

4. **Strong, S. A.** and L. D. Carr, "Non-Hamiltonian Kelvin wave generation on vortices in Bose-Einstein condensates," *arXiv e-prints*(Feb. 2018), arXiv:1803.00147 [cond-mat.quant-gas]

5. **Strong, S. A.** and L. D. Carr, "Non-Hamiltonian Dynamics of Quantized Vortices in Bose-Einstein Condensates," *ArXiv e-prints*(Dec. 2017), arXiv:1712.05885 [cond-mat.quant-gas]

6. B. Moskal, T. Reed-Rhoads, and **Strong,S**, "Quantitative and mixed-methods research: Approaches and limitations.." in *Cambridge Handbook of Engineering Education Research*, edited by A. Johri and B.M. Olds (Cambridge University Press, 2014) pp. 519–534

7. **S. A. Strong**, "The effects of direct observation on student responses in the renewable energy reu program at colorado school of mines," in *2013 IEEE Frontiers in Education Conference (FIE)* (2013) pp. 985–991, ISSN 0190-5848

8. Lincoln D. Carr, Rachel R. Miller, Daniel R. Bolton, and **Strong, Scott A.**, "Nonlinear scattering of a bose-einstein condensate on a rectangular barrier," *Phys. Rev. A* **86**, 023621 (Aug 2012), `http://link.aps.org/doi/10.1103/PhysRevA.86.023621`

9. **Scott A. Strong** and Lincoln D. Carr, "Generalized local induction equation, elliptic asymptotics, and simulating superfluid turbulence," *Journal of Mathematical Physics* **53**, 033102 (2012), http://dx.doi.org/10.1063/1.3696689, `http://dx.doi.org/10.1063/1.3696689`

10. C. Stone and **S. Strong**, "Implementing amp; evaluating undergraduate research in renewable energy at colorado school of mines," in *2012 Frontiers in Education Conference Proceedings* (2012) pp. 1–6, ISSN 0190-5848

11. **S. Strong** and B. M. Moskal, "Caveats of course coordination," in *Proceedings. Frontiers in Education. 36th Annual Conference* (2006) pp. 4–8, ISSN 0190-5848

12. B. Moskal, **S. Strong**, and G. Fairweather, "Assessing core courses in mathematics: Effects of multi-section coordination.." in *Assessment of student learning in college mathematics: Toward improved programs and courses*, edited by Bernard L. Madison (Association for Institutional Research, 2006)

Presentations, Interviews and Addresses

Talk **A SCALE-UP Instructional Environment for Multivariate Calculus in the Engineering Core**, *2019 ASEE RMS Conference*, Laramie, WY, May 19-21, 2019.
G. Gustave Greivel (presenter) and Scott A. Strong

Talk **Context Rich Differential Equations in the Engineering Core and SCALE-UP without Studios**, *2019 ASEE RMS Conference*, Laramie, WY, May 19-21, 2019.
Scott A. Strong (presenter) and G. Gustave Greivel

Invited Talk **Nonlinear Waves on Vortex Filaments in Quantum Liquids: A Geometric Perspective**, *Eleventh IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory*, Athens, GA, April 17-19, 2019.
co-author: Lincoln D. Carr

Invited Talk **Quantum Hydrodynamics and the Evolution of Vortex Lines**, *Nonlinear Waves Seminar*, Boulder, CO, Oct. 16, 2018.

Talk **A SCALE-UP Instructional Model for Multivariate Calculus**, *Math Fest*, Denver, CO, Aug. 2, 2018.
G. Gustave Greivel(presenter) and Scott A. Strong

Talk **Hamiltonian nonlinear dynamics of Newtonian Mechanics and Quantum Theory**, *Math Camp Seminar*, Golden, CO, July 19, 2018.

Talk **Geometric Quantum Hydrodynamics**, *Thesis Defense*, Golden, CO, May 7, 2018.
co–author: Lincoln D. Carr

Invited Talk **Nonlinear Phenomenon**, *AMS Math Club*, Golden, CO, March 5, 2018.

Talk **Geometric Quantum Hydrodynamics**, *Theoretical Physics Seminar*, Golden, CO, April 10, 2018.
co–author: Lincoln D. Carr

Talk **Vortex Filament Methods and the Generalized Local Induction Equation**, *Computational STEM Seminar*, Golden, CO, Jan. 23, 2018.
co–author: Lincoln D. Carr

Talk **Non-Hamiltonian Dynamics of Quantized Vortices** , 3^{rd} *Colorado Nonlinear Day*, Colorado Spring, CO, Nov. 11-12, 2017.
co–author: Lincoln D. Carr

Talk **Non-Hamiltonian Dynamics of Quantized Vortices**, *CSM Theoretical Physics Seminar*, Golden, CO, Oct. 31, 2017.
co–author: Lincoln D. Carr

Talk **Non-Hamiltonian Dynamics of Quantized Vortices** , *Annual Fall Meeting of the APS Four Corners Section* , Fort Collins, CO, October 20-21, 2017.
Session E4: Theoretical and Computational Condensed Matter I, co–author: Lincoln D. Carr

Panelist **Horizontal and Vertical Integration of the Studio Delivery Model** , *Mines Engineering Learning Conference*, Golden, CO, Aug. 16-17, 2017.

Talk **Serret-Frenet to Nonlinear Schrödinger and Beyond**, *CSM Theoretical Physics Seminar*, Golden, CO, Feb. 14, 2017.
co–author: Lincoln D. Carr

Talk **Nonlinear Binormal Flow of Vortex Filaments**, *Annual Meeting of the American Physical Society, Division of Fluid Dynamics*, Boston, MA, Nov. 22–24, 2015.
Superfluids Session (Chair), co–author: Lincoln D. Carr

Interview **Faculty Spotlight**, *Mines Oredigger*, Golden, CO, Oct. 2014.

Interview **Faculty Spotlight**, *Mines Internet Radio*, Golden, CO, 2014.

Talk **Generalized Hasimoto Transform, Binormal Flow and Quantized Vortices**, *APS March Meeting*, Denver, CO, March 3–7, 2014.
co–author: Lincoln D. Carr

Invited Talk **Faculty Address: The Banker the Evil Mother and Me**, *CSM Convocation*, Golden, CO, Aug. 18, 2013.

Poster **Self-Induced Vortex Filament Dynamics**, *Conference for Undergraduate Women in Physics*, Golden, CO, Jan. 18–20, 2013.
co–author: Lincoln D. Carr

Poster **Self-Induced Vortex Filament Dynamics**, *Dynamics Days*, Denver, CO, Jan. 3–6, 2013.
co–author: Lincoln D. Carr

Talk **Generalized Local Induction, Hasimoto's Map and Admissible Vortex Geometries**, *Arizona School of Analysis and Mathematical Physics*, Tuscon, AZ, March 12–16, 2012.
co–author: Lincoln D. Carr

Poster **Visualizing Vortex Filaments Through Integrable PDE**, *CSM Theoretical Physics Seminar*, Golden, CO, Nov. 14, 2011.
co–author: Lincoln D. Carr

Talk **Self-Induced Vortex Filament Dynamics**, *Boulder Summer School for Condensed Matter Physics*, Boulder, CO, July 12, 2011.
co–author: Lincoln D. Carr

Poster **Self-Induced Vortex Filament Dynamics**, *Boulder Summer School for Condensed Matter Physics*, Boulder, CO, July 15, 2011.
co–author: Lincoln D. Carr

Talk **Vortex Filaments, Local Induction and Simulating Quantum Turbulence**, *The Seventh IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory*, Athens, GA, April 4–7, 2011.
co–author: Lincoln D. Carr

Talk **Vortex Filaments, Local Induction and Simulating Quantum Turbulence**, *CSM Theoretical Physics Seminar*, Golden, CO, Jan. 22, 2011.
co–author: Lincoln D. Carr

Poster **The Locally Induced Dynamics of Thin Cored Vortex Geometries with Applications to Bose-Einstein Condensates**, *APS Division of Atomic, Molecular & Optical Physics (DAMOP)*, Houston, TX, May 25–29, 2010.
co–author: Lincoln D. Carr

Poster **Soliton Dynamics of a Line-Vortex Defect Embedded in an Incompressible Inviscid Fluid**, *CSM Graduate Student Research Fair*, Golden, CO, April 22, 2010.
co–author: Lincoln D. Carr

Talk **The Locally Induced Dynamics of Thin Cored Vortex Geometries**, *CSM Theoretical Physics Seminar*, Golden, CO, Nov. 23, 2009.
co–author: Lincoln D. Carr

Talk **Nonlinear Evolutions Equations - CMI Summer School 2008**, *CSM Theoretical Physics Seminar*, Golden, CO, Sept. 8, 2008.

Talk **Caveats of Course Coordination**, *Frontiers in Education Conference*, San Diego, CA, Oct. 27–Nov. 1, 2006.
co–author: Barbara M. Moskal

Talk **Assessing the mathematics core: A mixed method approach at the Colorado School of Mines**, *Joint Mathematics Meeting*, San Antonio, TX, Jan. 12–15, 2006.
co–author: Barbara M. Moskal and Graeme Fairweather

Talk **Fractal Geometry, Chaotic Dynamics and Music Composition**, *Davidson Institute - Young Scholars Program*, Golden, CO, 2002.

Workshops Attended

2015 SoTL (Scholarship of Teaching and Learning) Workshop
2014 American Society for Engineering Education: Advanced National Effective Teaching Institute
2013 American Society for Engineering Education: National Effective Teaching Institute
2013 Cornell Office for Research on Evaluation - Evaluation Partnership Phase II
2012 Arizona School of Analysis and Mathematical Physics
2011 Cornell Office for Research on Evaluation - Evaluation Partnership Phase I
2011 Boulder Summer School on Condensed Matter Physics: Hydrodynamics
2009 Nonlinear Finite Element Analysis 2009: Hughes and Belytschko
2008 Clay Mathematics Summer School: Evolution Equations

Awards & Honors

2014 Graduating Senior Outstanding Professor in Mathematics Award
2014 Order of Omega Outstanding CSM Faculty Award
2013 CSM Convocation: Faculty Address

2012–2014 CSM Faculty in CASA
2013 CSM Alumni Teaching Award
2009 Graduating Senior Outstanding Professor in Mathematics Award
2008 Graduating Senior Outstanding Professor in Mathematics Award

Courses Taught

MATH100 Introductory Topics For Calculus
CSM101 Freshmen Success Seminar
MATH111 Calculus For Scientists And Engineers I
MATH224 Calculus For Scientists And Engineers III w/ Honors
MATH225 Differential Equations
MATH235 Differential Equations w/ Honors
EPIC251 Engineering And Design Practices II
CSCI261 Introduction To Programing Concepts (C++)
MATH332 Linear Algebra
MATH399 Independent Study: Advanced Topics In Linear Algebra
MATH348 Advanced Engineering Mathematics
MATH499 Independent Study: Quantum Dynamical Systems
MATH499 Independent Study: Mathematical Mechanics
MATH499 Independent Study: Fourier Analysis With Applications
MATH499 Mathematics of Quantum Mechanics with Applications to Biology
CEEE599 Linear Methods for Environmental Engineers
CEEE599 Environmental Physics and Fluid Dynamics

Computer Skills

- **Mathematica**
  - Full professional proficiency
  - 10^+ years of experience
- **MATLAB**
  - Limited working proficiency
  - Coded routines for computational linear algebra numerical PDE
- **Linux/Unix**
  - Professional working proficiency
  - 10^+ years of experience
  - Administered several personal servers
- **HTML**
  - Professional working proficiency
- **C++**
  - Professional working proficiency
  - 5^+ years of experience
- **Python**
  - Limited working proficiency
  - Developed software for undergraduate differential equations
- **Wordpress**
  - Professional working proficiency
  - Administered wordpress site for courses since 2007

Professional Societies

American Mathematical Society, Mathematical Association of America, American Physical Society, American Society for Engineering Education