ANDREW E. SLAUGHTER*

email: andrew.e.slaughter@gmail.com
website: aeslaughter.github.com

Office Address

Materials Process Design and Control Laboratory
Sibley School of Mechanical and Aerospace Engineering
169 Frank H. T. Rhodes Hall
Cornell University
Ithaca, NY 14853-3801
607.229.1829

Home Address

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Education

PhD in Engineering, Applied Mechanics Option Apr. 2010
Montana State University, Bozeman, MT
Dissertation: *Numerical Analysis of Conditions Necessary for Near-surface Snow Metamorphism*

MS in Civil Engineering Aug. 2004
Washington State University, Pullman, WA
Thesis: *Design and Fatigue of a Structural Wood-Plastic Composite*

BS in Civil Engineering Aug. 2002
Michigan Technological University, Houghton, MI

Teaching Experience

National Science Foundation Postdoctoral Fellow Aug. 2011–May 2013
Cornell University, Ithaca, NY
- Substitute lectured and developed weekly quizzes for *Finite Element Analysis for Mechanical and Aerospace Design* (MAE4700/5700)

Adjunct Faculty and Instructor Aug. 2009–May 2011
Montana State University, Bozeman, MT
- Instructed *Mechanics: Statics and Dynamics* and *Mechanics of Materials*
- Developed and instructed *Snow and Avalanche Physics for Science Educators* (ECIV 591), a distance learning course for K–12 educators seeking a Masters of Science in Science Education degree that incorporates topics from snow formation, avalanche dynamics, and engineering
- Instructed an honors seminar, *Text and Critics* (UH201), a course in critical reading and analysis of fundamental texts in the humanities, arts, communication, social studies, science, and history of ideas

Graduate Teaching Fellow in K–12 Education (GK–12) July 2007–July 2009
National Science Foundation and Big Sky Institute, Bozeman, MT
- Partnered with a 5th grade teacher to assist in expanding his curriculum to foster excitement in science, technology, engineering, and mathematics (STEM) education
- Instructed 5th grade science 10 hours per week on topics including avalanche safety, snow physics, and structural engineering
- Developed a simple, low-cost, and complete snow science curriculum: *Snow Science: A Fifth Grade Perspective*

Research and Engineering Apprenticeship Program (REAP) Summers 2006–2008
Montana State University, Bozeman, MT
- Mentored recent high school graduates in conducting research at MSU
- Guided students on projects researching snow micro-penitents and snow albedo

Teaching Assistant   Aug. 2004–May 2010

Montana State University, Bozeman, MT
- Held regular office hours, substitute lectured, taught laboratory sections, graded homework and exams for *Fluid Mechanics*, *Concrete Technology and Structures*, and *Mechanics: Statics and Dynamics*

Research Experience

National Science Foundation Post-doctoral Fellow   Sept. 2011–present

Materials Process Design and Control Laboratory (MPDC)

Cornell University, Ithaca, NY Proposal Title: *A Stochastic Phase-tracking Snow Micro-structure Model*
- Researching and implementing a stochastic 3-D, phase-tracking finite element model of snow micro-structure that:
  - utilizes discontinuous Galerkin methods to solve the level set equation for tracking phase-change front,
  - solves the mass, momentum, and energy equations with micro-scale convection at the phase interface, and
  - implements parallel, adaptive domain decomposition solvers for efficient computation
- Improving the collaborative tools at the MPDC: confluence.cornell.edu/display/mpdc/Home
- Developing a web-based outreach tool to make resulting research widely accessible

Post-doctoral Researcher   Jun. 2010–Aug. 2010

Montana Space Grant Consortium Montana, NASA EPSCoR

Subzero Science Research and Engineering Facility

Montana State University, Bozeman, MT

Project: *Snow Near Surface Morphologies and Influence on Solar Albedo*
- Assisted in development of techniques for measuring and analyzing the bi-direction reflectance distribution function of snow in the visible and near-infrared wavelengths
- Co-authored the project final report
- Developed open-source image analysis software: Snow Optics Toolbox

PhD Research   Aug. 2004–Apr. 2010

Montana State University, Bozeman, MT

Dissertation: *Numerical Analysis of Conditions Necessary for Near-surface Snow Metamorphism*
- Utilized SOBOL sensitivity analysis and a finite-difference heat-transfer model to isolate important factors in near-surface metamorphism
- Performed laboratory simulations of near-surface facet metamorphism
- Established collaborative, ongoing research program with local ski resort and ski patrol
- Designed, implemented, and distributed various open-source software packages including a collaborative database system: YCweather

MS Research   Aug. 2002–Aug.2004

Composite Materials and Engineering Center

Washington State University, Pullman, WA

Thesis: *Design and Fatigue of a Structural Wood-Plastic Composite*
- Designed, tested, and implemented wood-plastic composite bridge decking for pedestrian bridge structures
- oversaw installation, testing, and reporting of a custom composite column connection

Eagle River Bridge Restoration Project   Dec. 2001–May 2002

Michigan Technological University, Houghton, MI
- Analyzed a closed 1909 truss bridge for design capacity and proposed retrofitting scheme

Grants Received

NSF 1049501; P.I. Andrew E. Slaughter; $170,000   Sept. 2011–Aug. 2013
Title: *A Stochastic Phase-tracking Snow Micro-structure Model*
National Science Foundation, Division of Earth Sciences, Postdoctoral Fellowship Program
> The goal of the work is to research the use of stochastic finite element methods to model the evolution of the snow micro-structure including phase change within the snow. A model of this type would improve the current understanding of snow metamorphism by providing a means to monitor the evolution of the ice matrix within the snow while accounting for uncertainties.

Fellowships and Scholarships

National Science Foundation GK-12 Graduate Fellowship (Jul. 2007 and Jul. 2008)
B.E. Grant Memorial Scholarship (Aug. 2007)
Inland Northwest Research Alliance Graduate Fellowship (Aug. 2005 and Aug. 2006)
Kenneth Tait Scholarship (Aug. 2005 and Aug. 2006)
American Avalanche Association Graduate Grant (Sept. 2005)
International Snow Science Workshop 2000 Graduate Grant (Sept. 2005)
Washington State University Graduate Scholarship (Jan. 2003)
Weyerhaeuser Graduate Fellowship (Aug. 2002)

Outreach Activities

Avalanche Field Course Instructor   2009–2011
Gallatin National Forest Avalanche Center, Bozeman, MT
- Instructed half-day basic avalanche field courses for community members and Montana State University students

Science Storms
Museum of Science and Industry, Chicago, IL
- Assisted in the development of an interactive game that explores snow avalanches

Presentation: "Is it Safe?"   Sept. 2008
International Snow Science Workshop, Whistler, BC
- Organized a presentation developed by 2007/2008 5th grade students, which was accepted and presented at the International Snow Science Workshop by student representatives
- Independently raised travel funds for the student presenters
- Featured in various regional news outlets via the MSU News Service

National, Regional, and Local News Appearances
- Involved in various local news stories of research conducted at Montana State University
- Appeared in the New York Times: *Solving Avalanches' Mysteries*
- Appeared on the Discovery Channel: *Survive This, Smokey Bear Balloon Crash*

Advanced Coursework

- Continuum Mechanics
- Advanced Engineering Analysis I & II
- Elastic and Inelastic Stress Analysis
- Finite Element Analysis
- Structural Dynamics
- Earthquake Engineering
- Advanced Mechanics of Materials
- Advanced Timber Design
- Advanced Fluid Mechanics

Computer and Technical Skills

Programming and Software Development Skills

■ Experienced with a wide variety of programming languages ■ Accomplished in building end-user applications, graphical interfaces, and code documentation ■ Proficient in parallel programming and various open-source finite element frameworks ■ Skilled with numerous visualization and meshing interfaces ■ Well versed with Windows and Linux operating systems, office software applications, and manuscript typesetting tools

- C++
- MATLAB
- Fortran
- Python
- GNU Octave
- R
- HTML
- LabView

- MathCAD
- PETSc
- Trilinos
- MPI
- libMesh
- FEniCS
- make
- Cmake

- Doxygen
- Git
- SVN
- Mercurial
- VTK
- ITK
- ImageMagick++
- CGAL

- ParaView
- LaTeX
- MS Office Suite
- Libre/OpenOffice
- Adobe Suite

Laboratory and Technical Skills

■ Proficient with the use of environmental instrumentation including pyranometers and infrared radiometers ■ Skilled with data recording and management include National Instruments and Agilent systems ■ Experienced with structural testing equipment including fatigue rated servo-hydraulic actuators ■ Practiced with a wide variety of tool and wood working equipment

Professional References

Prof. Edward Adams, *PhD Advisor*
205 Cobleigh Hall, Montana State University, Bozeman, MT 59717
eda@ce.montana.edu (406.994.6122)

Prof. Dan Miller, *Postdoctoral Supervisor*
205 Cobleigh Hall, Montana State University, Bozeman, MT 59717
dan.miller@ce.montana.edu (406.994.6118)

Prof. Michael Wolcott, *MS Advisor*
Composite Materials and Engineering Center, PO Box 641806, Washington State University, Pullman, WA 99164-1806
wolcott@wsu.edu (509.335.6392)

Publications

Peer-reviewed Journal Articles

[1] **A.E. Slaughter**, E.E. Adams, P.J. Staron, R.H. Shertzer, D.J. Walters, D. McCabe, D. Catherine, I. Henninger, T. Leonard, M. Cooperstein, and H. Munter. Field investigation of near-surface metamorphism of snow. *Journal of Glaciology*, 57(203):441–452, 2011.

[2] E.E. Adams, **A.E. Slaughter**, L.R. McKittrick, and D.A. Miller. Local terrain topography and thermal properties influence on energy and mass balance of a snowcover. *Annals of Glaciology*, A52(58):169–175, 2011.

[3] **A.E. Slaughter**, D. McCabe, H. Munter, P.J. Staron, E.E. Adams, D. Catherine, I. Henninger, M. Cooperstein, and T. Leonard. An investigation of radiation-recrystallization coupling laboratory and field studies. *Cold Regions Science and Technology*, 59(2–3):126–132, 2009.

[4] **A.E. Slaughter**, M.P. Wolcott, and D.I. McLean. Design of a wood-plastic composite bridge deck member. *Forest Products Journal*, accepted.

Journal Articles in Review

[1] **A.E. Slaughter** and E.E. Adams. Numerical investigation of the conditions leading to the formation of near-surface facets. *Cold Regions Science and Technology*.

[2] **A.E. Slaughter** and M.P. Wolcott. Static testing of structural polypropylene wood-plastic composites. *Wood and Fiber Science*, in review.

Proceedings and Presentations

[1] **A.E. Slaughter** and N. Zabaras. A phase-tracking snow micro-structure model. In *American Geophysical Union (AGU) Fall Meeting*, San Fransisco, CA, in review.

[2] **A.E. Slaughter** and N. Zabaras. A phase-tracking snow micro-structure model. In *International Snow Science Workshop*, Anchorage, AK, 2012.

[3] **A.E. Slaughter** and E.E. Adams. Field and analtyical examination of near-surface facets. In *International Snow Science Workshop*, Sqauw Valley, CA, 2010.

[4] E.E. Adams, **A.E. Slaughter**, L. McKittrick, and D.A. Miller. The coupling of snow near surface metamorphism and surface energy balance in complex alpine terrain. In *International Symposium on snow, ice and humaity in a changing climate*, Sapporo, JP, 2010.

[5] **A.E. Slaughter** and E.E. Adams. Numerical investigation of factors causing near-surface metamorphism. In *International Snow Science Workshop*, Davos, CH, 2009.

[6] E. Adams, L McKittrick, **A.E. Slaughter**, P. Staron, R. Shertzer, D. Miller, T. Leonard, D. McCabe, I. Henninger, D. Catharine, M. Cooperstein, and K. Laveck. Modeling variation of surface hoar and radiation recrystallization across a slope. In *International Snow Science Workshop*, Davos, CH, 2009.

[7] **A.E. Slaughter** and E.E. Adams. Importance and interaction of the energy balance components governing radiation-recrystallization of snow. In *Lessons from Continuity and Change in the Fourth International Polar Year*, 2009.

[8] Staron P.J., E.E. Adams, and **A.E. Slaughter**. Modeling and measuring albedo due to near-surface metamorphism. In *Lessons from Continuity and Change in the Fourth International Polar Year*, 2009.

[9] **A.E. Slaughter**, P.J. Staron, E.E. Adams, D. McCabe, H. Munter, D. Catherine, I. Henninger, M. Cooperstein, and T. Leonard. Laboratory simulations of radiation-recrystallization events in Southwest Montana. In *International Snow Science Workshop*, Whistler, BC, 2008.

[10] **A.E. Slaughter**, D.T. Neal, and Ophir School 2007/2008 Fifth Grade. Snow science as curriculum in a fifth grade classroom. In *International Snow Science Workshop*, Whistler, B.C., 2008.

[11] Ophir School 2007/2008 Fifth Grade, **A.E. Slaughter**, and D.T. Neal. Is it safe? An educational poster developed by grade school students for their peers. In *International Snow Science Workshop*, Whistler, B.C., 2008.

[12] D. McCabe, H. Munter, D. Catherine, I. Henninger, M. Cooperstein, T. Leonard, **A.E. Slaughter**, P.J. Staron, and E.E. Adams. Near-surface faceting on south aspects in Southweast Montana. In *International Snow Science Workshop*, pages 147–154, Whistler, B.C., 2008.

[13] **A.E. Slaughter**, E.E. Adams, T. Weas, and M. Hanson. Growth of snow mirco-penitents under controlled laboratory conditions. In *Environmental and Subsurface Science Symposium*, Moscow, ID, 2006.

[14] J.M. Staples, E.E. Adams, **A.E. Slaughter**, and L.R. McKittrick. Slope scale modeling of snow surface temperature in topographically complex terrain. In *International Snow Science Workshop*, pages 806–814, Telluride, CO, 2006.

[15] **A.E. Slaughter**, M.P. Wolcott, and D. McLean. Design of a wood-plastic composite deck board. In *Transportation Research Board 84th Annual Meeting*, 2005.

Technical Reports

[1] D.A. Miller, **A.E. Slaughter**, and B.T. Stanton. Snow near surface morphologies and influence on solar albedo. Final report, Montana Space Grant Consortium Montana NASA EPSCoR Research Initiation, Grant 4W2994, August 2011.