

# Eileen R. Martin

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Education	<b>Ph.D. Computational and Mathematical Engineering, Stanford University</b>	
	Dissertation:	expected June 2018
	<i>Passive Imaging and Characterization of the Subsurface with Distributed Acoustic Sensing</i>	
	Reading committee:	
	– Biondo Biondi, advisor (Geophysics and ICME, Stanford)	
	– Jonathan Ajo-Franklin (Geophysics, Lawrence Berkeley National Laboratory)	
	– George Papanicolaou (Mathematics and ICME, Stanford)	
	<b>M.S. Geophysics</b>	<b>Stanford University</b>
	Masters research presentation:	June 2017
	<i>Stanford DAS Array: Ambient Noise and Earthquake Recordings</i>	
Honors, Awards, Fellowships	Oral exam committee: Biondo Biondi and Greg Beroza (Geophysics, Stanford)	
	<b>B.S. Dean's Scholars Honors Mathematics, University of Texas at Austin</b>	
	Dean's Honored Graduate, graduated with high honors	May 2012
	Honors thesis: <i>Global Coordinate Systems: Continuously Moving Finite-Dimensional Unit Norm Tight Frames on Smooth Manifolds</i>	
	Advisor: Daniel Freeman (now Mathematics & Statistics, St. Louis University)	
	<b>B.S. Computational Physics</b>	<b>University of Texas at Austin</b>
	Graduated with high honors	May 2012
	<b>Schlumberger Innovation Fellowship</b>	2016-2017
	Award value \$10,000	
	1 Ph.D. student and 4 M.S. students selected by ICME faculty committee	
	<b>DOE Computational Science Graduate Fellowship</b>	2012-2016
	Award value over \$300,000	
	Approximately 20 students selected in 2012 throughout the United States	
	<b>ICME Xpo Best Poster Design</b>	2016
	<b>Travel Grant to attend SEG Annual International Meeting</b>	2015
	<b>ICME Student Leadership Award</b>	2014
	Annually awarded cash prize and plaque recognizing service to the institute	
	<b>NSF Graduate Research Fellowship Program</b> award offered	2012
	<b>Dean's Honored Graduate</b>	2012
	Fewer than 1% of students in UT-Austin College of Natural Sciences receive this award, selected through faculty panel vote	
	<b>Barry M. Goldwater Scholarship</b>	2011-2012

**Teaching,  
Mentoring**

**ICME Teaching Fellow** since 2016, status to recognize students with significant experience teaching, both formal TA or instructor positions and organizing informal reviews for younger students

**Mentor**, ICME first-year mentoring program Sep. 2017-Jun. 2018

**Mentor**, Stanford Women in Math Mentoring Oct. 2016-Jun. 2017

**Project Mentor**, Stanford Earth Summer Undergraduate Research Program  
Co-mentored geophysics undergraduate E. Williams Summer 2016  
Project on targeted detection/removal of infrastructure noise from ambient noise

**Course assistant**, Introduction to Scientific Computing Winter 2016  
CME 108/MATH 114 taught by Eric Dunham at Stanford

**Project Mentor**, Projects in App. & Comp. Math (CME 181) Spring 2015  
Undergrad project on statistical analysis of bicycle sharing network data

**Instructor of Record**, Introduction to Scientific Python Winter 2015  
CME 193, Stanford: 1 credit hr. pass/fail course for 46 undergrads and grads

**Instructor**, Short course on Python at SIAM Conference on Geosciences, June 2015  
Developed course with hands-on analysis and visualization of real geoscience data

**Project Mentor**, Projects in App. & Comp. Math (CME 181) Winter 2014  
Undergrad project on tsunami modeling using Hawaiian bathymetry

**STEM Tutor**, Longhorn Center for Academic Excellence, UT-Austin Division of Diversity and Community Engagement Aug. 2011-May 2012  
Tutored students in introductory math, statistics, physics, and chemistry courses  
Documented tutoring and workshops for grant application materials

**Research  
Experience**

**Stanford Distributed Acoustic Sensing Array** 2016-present  
*Led by PI Biondo Biondi at Stanford University funded by Stanford Exploration Project affiliates, and equipment donated by OptaSense, Inc.*  
Computational and theoretical data analysis:  
Developing theory and modeling to understand sensitivity to body and surface waves  
Analyzing convergence and time-lapse saturation effects on virtual source response estimates from ambient noise data spanning more than one year  
Leading development of open-source software for streaming DAS arrays  
Investigated DAS recordings of teleseismic and regional earthquakes and quarry blasts  
Experimental design, deployment, and field work:  
Coordinated 1 week of simultaneous on-campus recording by 2 DAS interrogator units and 3 portable broadbands (from USGS) for comparison  
Co-organized active survey of Stock Farm Monocline with C. Castillo, conducted by 22 volunteers over 4 days in March 2017: 37 betsy gun shots and 106 x 4 sledgehammer hits recorded on DAS array and 98 3C nodes (from USSS)  
Collaborated with Stanford IT, B. Biondi, and OptaSense to design 2.5 km long array following Stanford's existing telecomm conduits within budget  
Arranged material purchases and scheduling labor for array installation  
Mentoring junior students:

Mentored new student, S. Yuan, as he developed automated earthquake analysis tools  
 Led weekly seminar on projects using the DAS array data, summer 2017  
 Guided undergrad S. Sawasdee processing Stock Farm Monocline DAS & node data  
 Assisted graduate students F. Huot, Y. Ma and R. Cieplicki developing machine  
 learning tools to automate exploration/filtering of seismic noise in urban areas

**Permafrost Thaw Monitoring with DAS and ambient noise** 2014-present  
*Led by PI Jonathan Ajo-Franklin at Lawrence Berkeley National Lab and co-PI Anna Wagner at US Army Cold Regions Research and Engineering Lab, funded by DOD under SERDP grant RC-2437 "Developing Smart Infrastructure for a Changing Arctic Environment Using Distributed Fiber-Optic Sensing Methods"*

Calculating ambient noise cross-correlations throughout 2016 Fairbanks, AK 2D DAS array during thaw test to compare predicted and actual sensitivities  
 In process of regular collaboration, became LBL affiliate in 2016  
 Based on results of Rayleigh-wave interferometry on ambient noise recorded in 2015 at Fairbanks, AK DAS array, identified and developed model for artifacts due to vehicle-related noise recorded by passive arrays near roadways  
 Developed and implemented embarrassingly parallel, scalable method for dispersion image calculation in arrays of many sensors  
 Performed early investigation of ambient noise interferometry pre-processing along linear segments of 2014 passive data from Richmond Field Station  
 Field work helping deploy trenched fiber array for pilot at Richmond Field Station

**High-performance solver libraries for seismic inversion** 2013, 2017  
*Small group software development led by Robert Clapp in Stanford Exploration Project*  
 Coded and tested parts of SEPVector, a C++ library of data storage objects easily adaptable to new architectures for inverse problems (2013)  
 Coding and testing non-linear solver for C++ in-core solver library with Python wrappers, built on top of SEPVector-like-objects and designed to mimic existing out-of-core solver library (2017)

**Butterfly Factorization** 2013-2014  
*Collaboration with H. Yang and Y. Li led by PI Lexing Ying*  
 Coded and tested parts of serial implementation of multi-scale-type factorization scheme that is fast to apply and inexpensive to store

**Improving memory performance of laser-plasma simulations** Summer 2014  
*DOE CSGF Practicum supervised by S. Langer in Weapons & Complex Integration at Lawrence Livermore National Laboratory*  
 Improved memory performance of pf3D code by combining physics operators  
 Evaluated hardware compression needs

**Finite Unit Norm Tight Frames (FUNTF) Research** 2010-2012  
*Participated in NSF REU on Matrix Analysis and Wavelets at Texas A&M University, led by D. Larson and mentored by D. Freeman, then continued research supervised by D. Freeman at UT-Austin in Mathematics Department*  
 Found and proved method to automatically create a continuously moving FUNTF on any odd-dimension sphere using equivalent graph problem

**Moncrief Undergraduate Summer Research Internship** Summer 2011  
*Supervised by O. Ghattas and G. Stadler at UT-Austin ICES*  
 Implemented methods for seismic imaging using blended sources

**Numerical Analysis Research Assistant** 2009-2011

*Supervised by R. van de Geijn in UT-Austin CS Department*  
 Helped implement solvers for Lyapunov equation  
 Developed proofs of linear algebra error results for graduate course materials

**Refereed  
Journal  
Papers**

E.R. Martin, F. Huot, Y. Ma, R. Cieplicki, S. Cole, M. Karrenbach, B.L. Biondi, *Fiber optic seismic signal retrieval in an urban area with unsupervised learning for coherent noise removal* (accepted pending minor revisions to IEEE Signal Processing Magazine special issue on subsurface exploration).

N.J. Lindsey, E.R. Martin, S. Cole, D. Dreger, S. James, B. Freifeld, B. Biondi, J. Ajo-Franklin, *Fiber-optic network observations of earthquake wavefields*, accepted to Geophysical Research Letters, DOI: 10.1002/2017GL075722.

S. Dou, N. Lindsey, A. Wagner, T. Daley, B. Freifeld, M. Robertson, J. Peterson, C. Ulrich, E.R. Martin, J. Ajo-Franklin, *Distributed Acoustic Sensing for Seismic Monitoring of the Near Surface: A Traffic-Noise Interferometry Example*, Scientific Reports, 7 (2017), article 11620.

Y. Li, H. Yang, E.R. Martin, K.L. Ho, L. Ying, *Butterfly Factorization*, Multiscale Model. Simul., 13 (2015), pp. 714-732.

D. Freeman, R. Hotovy, E.R. Martin, *Moving finite unit norm tight frames for  $S^n$* , Illinois J. of Math, 58 (2014), pp. 311-322.

**Professional  
Magazines**

E.R. Martin, C. Castillo, S. Cole, S. Sawasdee, S. Yuan, R. Clapp, M. Karrenbach, B. Biondi, *Seismic Monitoring Leveraging Existing Telecomm Infrastructure at the Stanford Distributed Acoustic Sensing Array: Active, Passive and Ambient Noise Analysis*, The Leading Edge, 36(12), pp. 1025-1031.

**Submitted or  
in Preparation**

E.R. Martin, B. Biondi, *A fast, scalable algorithm for dispersion images from ambient noise* (in preparation, code at <https://github.com/eileenrmartin/FastDispersionImages>).

**Conference  
Papers**

E.R. Martin and B.L. Biondi, *Ambient noise interferometry across two-dimensional DAS arrays*, 2017, 87th Ann. Internat. Mtg. SEG Expanded Abstracts.

B. Biondi, E.R. Martin, S. Cole, M. Karrenbach, N. Lindsey, *Earthquakes analysis using data recorded by the Stanford DAS array*, 2017, 87th Ann. Internat. Mtg. SEG Expanded Abstracts.

F. Huot, Y. Ma, R. Cieplicki, E.R. Martin, B. Biondi, *Automatic noise exploration in urban areas*, 2017, 87th Ann. Internat. Mtg. SEG Expanded Abstracts.

J.B. Ajo-Franklin, S. Dou, N. Lindsey, T. Daley, B. Freifeld, E.R. Martin, C. Ulrich, T. Wood, I. Eckblaw, A. Wagner, M. Robertson, *Timelapse surface wave monitoring of permafrost thaw using distributed acoustic sensing and a permanent automated seismic source*, 2017, 87th Ann. Internat. Mtg. SEG Expanded Abstracts.

E.R. Martin, B. Biondi, M. Karrenbach, S. Cole, *Ambient noise interferometry from*

*DAS array in underground telecommunications conduits*, 2017, EAGE Annual Meeting Proceedings.

E.R. Martin, B.L. Biondi, M. Karrenbach, S. Cole, *Continuous Subsurface Monitoring by Passive Seismic with Distributed Acoustic Sensors- The “Stanford Array” Experiment*, 2017, Extended Abstracts of the First EAGE Workshop on Practical Reservoir Monitoring, Amsterdam.

E.R. Martin, P. Wills, D. Hohl, J.L. Lopez, *Using machine learning to predict production at a Peace River thermal EOR site*, Proceedings of the 2017 SPE Reservoir Simulation Conference. SPE-192696-MS.

E.R. Martin, N.J. Lindsey, S. Dou, J.B. Ajo-Franklin, A. Wagner, K. Bjella, T.M. Daley, B. Freifeld, M. Robertson, C. Ulrich, *Interferometry of a roadside DAS array in Fairbanks, AK*, 2016, 86th Ann. Internat. Mtg. SEG Expanded Abstracts.

E.R. Martin, J. Ajo-Franklin, N. Lindsey, T.M. Daley, B. Freifeld, M. Robertson, C. Ulrich, S. Dou, A. Wagner, *Interferometry of ambient noise from a trenched distributed acoustic sensing array*, 2015, 85th Ann. Internat. Mtg. SEG Expanded Abstracts.

J. Ajo-Franklin, N. Lindsey, T.M. Daley, B. Freifeld, E.R. Martin, M. Robertson, C. Ulrich, A. Wagner, *A field test of distributed acoustic sensing for ambient noise recording*, Expanded Abstracts of the 2015 SEG Ann. Internat. Mtg.

## Technical Reports

E.R. Martin, B. Biondi, G. Fabient-Ouellet, R.G. Clapp, *Sensitivity analysis of distributed acoustic sensing arrays*, SEP 170, 2017.

E.R. Martin, B. Biondi, *Time-lapse changes in ambient noise interferometry and dispersion analysis at the Stanford DAS Array*, SEP 170, 2017.

R. Clapp, S. Farris, T. Dahlke, E.R. Martin, *C++11 non-linear solver*, SEP 170, 2017.

E.R. Martin, B. Biondi, S. Cole, M. Karrenbach, *Overview of the Stanford DAS Array-1 (SDASA-1)*, SEP 168, 2017.

B. Biondi, E.R. Martin, S. Cole, M. Karrenbach, *Earthquakes analysis using data recorded by the Stanford DAS Array*, SEP 168, 2017.

E.R. Martin, B. Biondi, *Ambient noise interferometry on two-dimensional DAS arrays*, SEP 168, 2017.

F. Huot, Y. Ma, R. Cieplik, E.R. Martin, B. Biondi, *Automatic noise exploration in urban areas*, SEP 168, 2017.

E. Williams, E.R. Martin, *Detection and removal of coherent anthropogenic noise from passive seismic data*, SEP 165, 2016.

E.R. Martin, N. Lindsey, S. Dou, J. Ajo-Franklin, A. Wagner, K. Bjella, T. Daley, B. Freifeld, M. Robertson, C. Ulrich, *Interferometry of a roadside DAS array in Fairbanks, AK*, SEP 163, 2016.

E.R. Martin, J. Ajo-Franklin, N. Lindsey, T. Daley, B. Freifeld, M. Robertson, C.

Ulrich, S. Dou, A. Wagner, *Applying interferometry to ambient seismic noise recorded by a trenched distributed acoustic sensing array*, SEP 158, 2015.

E.R. Martin, *Compression for effective memory bandwidth use in forward modeling*, SEP 152, 2014.

E.R. Martin, R. Clapp, H. Le, C. Leader, D. Nichols, *SEPVector: a C++ inversion library*, SEP 152, 2014.

M. Denolle, S. de Ridder, J. Chang, E.R. Martin, T. Dahlke, H. Arevalo-Lopez, Sr., S. Levin, *Scholte-wave excitation*, SEP 150, 2013.

## Selected Talks

Upcoming: *Scalable seismic monitoring with fiber optics beneath our feet*, Heiland  
Lecture at Colorado School of Mines Golden, CO, Jan. 2018

Upcoming: *Earthquake recording at the Stanford DAS Array with fibers in existing telecom conduits* (invited talk) AGU Fall Meeting, New Orleans, LA, Dec. 2017

*Active and passive recording at the Stanford DAS Array*, SEG Annual Meeting  
Workshop: DAS, a vision of the future? Houston, TX, 2017

*DAS in existing telecommunications conduits on the Stanford campus*, SPE Workshop  
on Distributed Fiber-Optic Sensing for Well, Reservoir and Facilities Management  
Denver, CO, 2017

*Urban ambient noise: from dense nodes to DAS*, EAGE Annual Meeting:  
workshop on linking active and passive seismics Paris, France, 2017

*Repurposing our Telecommunications Infrastructure for Seismology*, Lawrence  
Livermore National Laboratory Seismology Seminar Livermore, CA, 2017

*Dirt Cheap Surveys: near surface monitoring with ambient seismic noise collected by DAS*, EAGE Annual Meeting: workshop on reservoir monitoring with  
distributed fibre-optic sensing Vienna, Austria, 2016

*Near-surface monitoring using DAS + ambient noise*, SEG Annual Meeting:  
distributed acoustic sensing workshop New Orleans, LA, 2015

## Professional Service

Reviewer for:  
– Computers & Geosciences  
– Journal of Computational Science  
– Journal of Environmental & Engineering Geophysics  
– Interpretation

Special section editor, *Interpretation* to appear Nov. 2018  
Special issue on ‘Distributed Acoustic Sensing and its Exploration Potential’

Co-organizer, Computational Geosciences Seminar, EARTH 310 Jan.-Mar. 2018

Session co-chair Sep. 2017  
“Earth Model Building Strategies and Inputs” at SEG Annual International Mtg.

	Helped organize SEG Data Analytics Post-Convention Workshop Invited early-career speakers and moderated panel on data science education	Sep. 2017
	Student panel for Stanford Aeronautics & Astronautics faculty search,	Spring 2017
	Stanford SEG student chapter president Coordinated event times and advertising with Bay Area Geophysical Society Organized and advertised events including: Distinguished Instructor Short Course (O. Yilmaz), SEG/AAPG Distinguished Lecture (D. Hale), SEG North American Honorary Lecture (A. Abubakar)	2014-2015
	Consultative Committee Member Group of roughly 15 students, faculty, staff and donors tasked with recommending UT-Austin Dean of Natural Sciences after conducting candidate interviews	Jul. 2011- Apr. 2012
	Chair, Dean's Scholars Distinguished Lecture Series, Led group of 4-6 students organizing university-wide events, each consisting of a public lecture, reception and dinner in budget of roughly \$700 Hosted astronaut/physician Michael Barratt and mathematician Richard Tapia	Jun. 2011-May 2012
<b>Industry Experience</b>	<b>High Performance Computing Internship</b> Schlumberger, Menlo Park, CA <i>Mentored by A. Lichnewsky and R.G. Clapp, and supervised by C. Boneti</i> Benchmarked, co-developed, and tested compression scheme for HPC applications	Summer 2016
	<b>Areal Monitoring Internship</b> Shell Projects & Technology, Houston, TX <i>Mentored by J. Lopez and supervised by P. Wills</i> Applied machine learning techniques to analyze data and predict production at steam-driven bitumen field in Peace River Regularly consulted with reservoir engineer to develop useful products	Summer 2015
	<b>Computational Physics Internship</b> Nanohmics, Inc. Austin, TX <i>Project funded through U.S. Department of Defense, PI B. Zollars</i> Implemented unstructured adaptive mesh methods for finite element code to model liquid erosion of coated lenses	2010-2011
<b>Skills</b>	Preferred programming languages: C/C++ and Python HPC tools: MPI, openMP, CUDA, TBB Profiling tools: Tau, HPM, NVCC, Vampir Scientific tools: MATLAB, Mathematica, COMSOL, IDL Environment and development tools: Google Cloud Compute Engine, Docker, Singularity, Doxygen, Git, Jupyter Notebooks	