Eileen R. Martin

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https://eileenrmartin.github.io/

Academic Appointments

Assistant Professor, Virginia Tech, Blacksburg, VA — Aug. 2018 - present
- Department of Mathematics (primary appointment)
- Program in Computational Modeling and Data Analytics

Affiliate, Lawrence Berkeley National Laboratory, Berkeley, CA — Sep. 2016 - present
- Earth and Environmental Sciences Area, Geophysics Department

Education

Ph.D. Computational and Mathematical Engineering, **Stanford University**
Dissertation: June 2018
Passive Imaging and Characterization of the Subsurface with Distributed Acoustic Sensing
Readers: Biondo Biondi (advisor), Jonathan Ajo-Franklin, George Papanicolaou

M.S. Geophysics **Stanford University**
Masters research presentation: June 2017
Stanford DAS Array: Ambient Noise and Earthquake Recordings
Committee: Biondo Biondi (advisor) and Greg Beroza

B.S. Dean's Scholars Honors Mathematics, **University of Texas at Austin**
Dean's Honored Graduate, graduated with high honors May 2012
Honors thesis: *Global Coordinate Systems: Continuously Moving Finite-Dimensional Unit Norm Tight Frames on Smooth Manifolds*
Advisor: Daniel Freeman (advisor, now at St. Louis University)

B.S. Computational Physics **University of Texas at Austin**
Graduated with high honors May 2012

Honors, Awards, Fellowships

Luther and Alice Hamlett Junior Faculty Fellow 2019-present
Fellowship in Virginia Tech's Academy of Integrated Science

Gene Golub Dissertation Award 2018
Top dissertation, Institute for Computational and Mathematical Engineering, Stanford

Best student poster paper at SEG Annual Meeting, co-author 2017
Awarded for Huot et al., *Automatic Noise Exploration in Urban Areas*

Schlumberger Innovation Fellowship 2016-2017
Value $10,000; Awarded to 1 Ph.D. student and 4 M.S. students in ICME

DOE Computational Science Graduate Fellowship 2012-2016
Value over $300,000; Awarded to approximately 20 students selected in 2012 throughout the United States

ICME Student Leadership Award 2014

NSF Graduate Research Fellowship Program award offered 2012

Dean's Honored Graduate 2012
Faculty vote to award to 1% of students in UT-Austin College of Natural Sciences

Barry M. Goldwater Scholarship 2011-2012

Funding

DOE DE-FOA-0001990
Amount: $1,874,999 total = $1,499,999 DOE + $375,000 non-DOE
Fully Distributed Acoustic and Magnetic Field Monitoring via a Single Fiber Line for Optimized Production of Unconventional Resource Plays
Lead PI: G. Pickrell (Virginia Tech Materials Science and Engineering), PIs: L. Ma (Sentek Instrument LLC), E.R. Martin
Period of performance: 10/1/19-6/30/22

NSF 1937984, Engineering for Civil Infrastructure program
Amount: $157,973
EAGER: Exploration of an Interdisciplinary Approach to Resolving a Critical Issue in Evaluating Liquefaction Hazard of Challenging Soil Sites
PI: E.R. Martin, Co-PIs: A. Yerro Colom and R. Green (both Virginia Tech Civil & Environmental Engineering)
Period of Performance: 8/1/19-12/31/20

UT-Batelle, LLC (for DOE c/o Oak Ridge National Laboratory) Subcontract 4000175567
Amount: $37,343
Fast Comparative Algorithms for Sensor Array Summaries
PI: E.R. Martin
Period of Performance: 11/11/19-8/1/19

MAA Tensor Women and Mathematics Grant
Amount: $6,000
SURE: Speakers and Undergraduate Research Engagement
PI: G. Matthews (Virginia Tech Math), Co-PIs: E.R. Martin and L. Zietsman (Virginia Tech Math)
Period of performance: 6/1/19-5/31/20

Seed Grant from Penn State Institute of Energy and the Environment
Amount: $50,000
Lighting Up the Subsurface for Tomorrow's City: Initiating a Penn State DAS Array for Mapping Near-Surface Geology
PI: T. Zhu (Penn State Geosciences), Co-PIs: E.R. Martin, A. Nyblade (Penn State Geosciences), P. Fox (Penn State Civil & Env. Engineering)
Period of performance: 3/1/19-12/31/19

DOE Phase I STTR DE-SC0019630
Amount: $149,997
Advanced Computational Methods Towards High-Resolution Fiber Optic Distributed Acoustic Sensing
PI: D. Rountree (Luna Innovations), Co-PI: E.R. Martin
Period of performance: 2/19/19-11/18/19

Papers Under Review

E.R. Martin, *A Linear Algorithm for Ambient Seismic Noise Double Beamforming Without Crosscorrelations,* under review.
Preprint available at https://vtechworks.lib.vt.edu/handle/10919/96246.
Code available at https://github.com/eileenrmartin/doubleBeamforming.

G. Fang, Y.E. Li, Y. Zhao, **E.R. Martin**, *Urban Near-surface Seismic Monitoring using Distributed Acoustic Sensing*, under review. Preprint available at https://eartharxiv.org/7n6ub/.

Z.J. Spica, M. Perton, **E.R. Martin**, G.C. Beroza, B.L. Biondi, *Urban Seismic Site Characterization by Fiber-Optic Seismology*, under review. Preprint available at https://eartharxiv.org/j8vn9/.

E.R. Martin, N.J. Lindsey, B. Biondi, J.B. Ajo-Franklin, *Introduction to Interferometry of Fiber Optic Strain Measurements* under review following minor revisions for upcoming AGU book on DAS. Preprint available at https://eartharxiv.org/sx9zt/.

B. Biondi, S. Yuan, **E.R. Martin**, F. Huot, R.G. Clapp, *Using telecommunication fiber infrastructure for earthquake monitoring and near-surface characterization*, accepted to upcoming AGU book on DAS.

Journal Articles

E.R. Martin, F. Huot, Y. Ma, R. Cieplicki, S. Cole, M. Karrenbach, B.L. Biondi, 2018, *A Seismic Shift in Scalable Acquisition Demands New Processing: Fiber-Optic Seismic Signal Retrieval in Urban Areas with Unsupervized Learning for Coherent Noise Removal*, IEEE Signal Processing Magaine, **35**(2), pp. 31-40.

N.J. Lindsey, **E.R. Martin**, S. Cole, D. Dreger, S. James, B. Freifeld, B. Biondi, J. Ajo-Franklin, 2017, *Fiber-Optic Network Observations of Earthquake Wavefields*, Geophysical Research Letters, **44**(23), pp. 11792-11799, (featured on cover of issue).

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

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

D. Freeman, R. Hotovy, **E.R. Martin** (alphabetical ordering standard for this journal), 2014, *Moving Finite Unit Norm Tight Frames for S^n*, Illinois J. of Math, 58, pp. 311-322.

Professional Magazines

E.R. Martin, C. Castillo, S. Cole, S. Sawasdee, S. Yuan, R. Clapp, M. Karrenbach, B. Biondi, 2017, *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.

Conference Papers

F. Huot, **E.R. Martin**, Z. Spica, B. Biondi, *Distributed Acoustic Sensing (DAS) for large-scale urban monitoring and geologic hazard mitigation using preexisting telecommunication infrastructure*, 2019, SEG/EAGE Workshop on Geophysical Aspects of Smart Cities, Singapore, 10-12 Dec.

T. Zhu, **E.R. Martin**, J. Shen, *New Signals in Massive Data Acquired by Fiber Optic Seismic Monitoring Under Pennsylvania State University*, 2019, SEG/EAGE Workshop on Geophysical Aspects of Smart Cities, Singapore, 10-12 Dec., preprint.

E.R. Martin, *Scalable Seismic Acquisition and Algorithms for Next-Generation Engineering Geophysics*, (invited) 2019, International Conference on Engineering Geophysics, Al Ain, United Arab Emirates, 9-12 Oct.

E.R. Martin, *A Scalable Algorithm for Cross-correlations of Compressed Ambient Seismic Noise*, 2019, 89th Ann. Internat. Mtg. SEG Expanded Abstracts. doi: 10.1190/segam2019-3216637.1

E.R. Martin, B. Biondi, *Eighteen months of near-surface monitoring with ambient noise at the Stanford Fiber Optic Seismic Observatory*, 2018, 88th Ann. Internat. Mtg. SEG Expanded Abstracts. doi: 10.1190/segam2018-2997853.1

F. Huot, **E.R. Martin**, B. Biondi, *Automated ambient-noise processing applied to fiber-optic seismic acquisitions (DAS)*, 2018, 88th Ann. Internat. Mtg. SEG Expanded Abstracts. doi: 10.1190/segam2018-2997880.1

E.R. Martin and B.L. Biondi, *Ambient noise interferometry across two-dimensional DAS arrays*, 2017, 87th Ann. Internat. Mtg. SEG Expanded Abstracts. doi: 10.1190/segam2017-17677759.1

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. doi: 10.1190/segam2017-17745041.1

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 (awarded best student poster paper). doi: 10.1190/segam2017-17774369.1

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. doi: 10.1190/segam2017-17774027.1

E.R. Martin, B. Biondi, M. Karrenbach, S. Cole, *Ambient noise interferometry from DAS array in underground telecommunications conduits*, 2017, EAGE Annual Meeting Proceedings. doi: 10.1190/segam2017-17774027.1

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 1st EAGE Workshop on Practical Reservoir Monitoring. doi: 10.3997/2214-4609.201700017

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. doi: 10.2118/182696-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. doi: 10.1190/segam2016-13963708.1

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. doi: 10.1190/segam2015-5902207.1

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. doi: 10.1190/segam2015-5926936.1

Technical Reports

E.R. Martin, *Eighteen months of continuous near-surface monitoring with DAS data collected under Stanford University*, SEP 172, 2018.

F. Huot, **E.R. Martin**, B. Biondi, *Automated ambient noise processing applied to fiber optic seismic acquisition*, SEP 172, 2018.

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. Cieplicki,**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

New Signals in Massive Data Acquired by Fiber Optic Seismic Monitoring Under Pennsylvania State University, SEG/EAGE Workshop on Geophysical Aspects of Smart Cities — Singapore, Dec. 2019

High-throughput seismology: new sensors, new signals, new algorithms, Women in Data Science at Stanford Earth (invited) — Stanford, CA, Nov. 2019

Scalable Seismic Acquisition and Algorithms for Next-Generation Engineering Geophysics,

International Conference on Engineering Geophysics (invited) Al Ain, UAE, Oct. 2019

Seismology at Unprecedented Scale, BiSEPPS Seminar at Harvard University Cambridge, MA, May 2019

Fast Algorithms for Ultra-high-resolution Ambient Noise Interferometry, Solid Earth Brownbag Seminar at Princeton University Princeton, NJ, May 2019

An Introduction to Seismology with Distributed Acoustic Sensing (tutorial talk) AGU Fall Meeting, video of material on YouTube Washington, DC, Dec. 2018

Beyond cosine squared: understanding trends in passive DAS data, SEG Annual Meeting Workshop on DAS Anaheim, CA, Oct. 2018

Pushing for Continuous, Dense, Urban Seismic Monitoring at the Stanford Fiber Optic Seismic Observatory (plenary talk) IRIS Workshop: Foundations, Frontiers and Future Facilities for Seismology Albuquerque, NM, Jun. 2018

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

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 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

Associate editor, *Computers & Geosciences* Nov. 2018-present

Committee member, SEG Research Committee Oct. 2018-present

Reviewer: *Seismological Research Letters, American Geophysical Union Books, Geophysical Journal International, Geophysics, Computers & Geosciences, Marine Geophysical Research, Journal of Computational Science, Journal of Environmental and Engineering Geophysics, Interpretation*

Co-chair, SEG/EAGE Workshop on Geophysical Aspects of Smart Cities, session on Fiber-based Distributed Acoustic Sensing Dec. 2019

Co-Organizer, SEG Annual International Meeting Post-convention Workshop on Real-time Processing for Large-Scale Streaming Seismic Data, agenda Sep. 2019

Chair, Session on 'Distributed Acoustic Sensing: VSP, Modeling and Imaging Approaches' at SEG Annual International Meeting Sep. 2019

Co-Organizer, Session on 'Photonic and Nonintertial Seismology' at Seismological Society of America Annual Meeting Apr. 2019

Organizer, Session on 'Computational Advances for Large-Scale Geophysical Data' at SIAM CS&E Feb. 2019
Special section associate editor, *Interpretation* 2018
Special issue on 'Distributed Acoustic Sensing and its Oil Field Potential'
Co-organizer, Stanford Computational Geosciences Seminar Jan.-Mar. 2018
Brought in 9 speakers from outside Stanford, organized 1 hr. course EARTH 310
Co-chair, Session on 'Earth Model Building Strategies and Inputs' at SEG Annual International Meeting Sep. 2017
Co-organizer, SEG Data Analytics Post-Convention Workshop Sep. 2017
Invited early-career speakers and moderated panel on data science education
Student panel Stanford Aeronautics & Astronautics faculty search Spring 2017
President, Stanford SEG student chapter 2014-2015

Teaching

Instructor, Extreme-Scale Inverse Problems (VT, MATH 5984) Fall 2019
Instructor, Integrated Quantitative Science I (VT, CMDA 2005) Fall 2019
Project Mentor, Capstone Project (VT, CMDA 4864) Fall 2019
Senior team project on removing footstep signals from urban seismic data
Instructor, CS Foundations for CMDA (VT, CMDA 3634) Spring 2019
Instructor, Integrated Quantitative Science I (VT, CMDA 2005) Fall 2018
ICME Teaching Fellow 2016-2018, status to recognize student teaching experience
Course assistant, Intro. to Scientific Computing (Stanford, CME 108) Winter 2016
Project Mentor, Projects in App. & Comp. Math (CME 181) Stanford, Spring 2015
Undergrad project on statistical analysis of bicycle sharing network data
Instructor, Introduction to Scientific Python (Stanford, CME 193) Winter 2015
Instructor, Short course on Python at SIAM Conference on Geosciences, June 2015
Project Mentor, Projects in App. & Comp. Math (CME 181) Stanford, Winter 2014
Undergrad project on tsunami modeling using Hawaiian bathymetry
STEM Tutor, Longhorn Center for Academic Excellence Aug. 2011-May 2012
UT-Austin Division of Diversity and Community Engagement
Tutored students in introductory math, statistics, physics, and chemistry courses
Documented tutoring and workshops for grant application materials

Research Advising

Masters Student Supervised

Joseph Kump, Mathematics M.S. student VT, May 2019 - present
Project on efficient high-resolution subsurface imaging methods

Undergraduate Students Supervised

Sarah Morgan, Mathematics undergraduate VT, Fall 2019
Project on sparse-basis template matching algorithm
Anu Trivedi, Mathematics undergraduate VT, Fall 2019
Project on fast denoising of X-ray tomography imaging
Tarun Nadipalli, CMDA undergraduate VT, Spring 2019
Awarded Hamlett Undergraduate Research Fellowship
Project on large-scale sensor network data compression
Ethan Williams, Geophysics and Music undergraduate Stanford, Summer 2016
Co-advised with Biondo Biondi
Project on targeted removal of infrastructure noise in ambient seismic data
Next position: PhD student in Geophysics at Caltech

Committee Membership

Kaleigh Yost, Ph.D. student of Russell Green in Department of Civil and Environmental Engineering VT, degree in progress
Amin Baghbadorani, Ph.D. student of John Hole in Department of Geosciences

VT, degree in progress
Taewon Cho, Ph.D. student of Julianne Chung in Department of Mathematics
VT, degree in progress

Educational Service, Mentoring

Mentor, DOE CSGF High Performance Computing Workshop — Jul. 2019
Panelist, Early Career Panel, DOE CSGF Annual Program Review — Jul. 2019
Co-organizer, Speakers and Undergraduate Research Engagement — Feb. 2019 - present
Program to guide female undergrad math students through their first research projects, and to bring in diverse women mathematician speakers for research talks and career path discussions
Faculty sponsor, Women in Data Science conference at VT — Feb. 2019 - present
Mentor, Student mentoring program run by Virginia Tech chapter of American Women in Mathematics — Sep. 2018 - present
Member, CMDA Computing Curriculum Committee — Aug. 2018 - present
Member, Math Department Technology Committee — Aug. 2018 - present
Speaker, Virginia Tech Undergraduate Math Club — Apr. 2019
Volunteer, ASA DataFest at Virginia Tech — Apr. 2019
Judge, CMDA Fall Data Competition at Virginia Tech — Nov. 2018
Panelist, UT-Austin American Women in Mathematics career panel — Nov. 2018
Speaker, UT-Austin Undergraduate Math Club — Nov. 2018
Mentor, ICME first-year mentoring program — Sep. 2017-Jun. 2018
Mentor, Stanford Women in Math Mentoring — Oct. 2016-Jun. 2017

Industry Experience

High Performance Computing Internship — Summer 2016
Schlumberger, Menlo Park, CA
Mentored by A. Lichnewsky and R.G. Clapp, and supervised by C. Boneti
Benchmarked, co-developed, and tested compression scheme for HPC applications

Areal Monitoring Internship — Summer 2015
Shell Projects & Technology, Houston, TX
Mentored by J. Lopez and supervised by P. Wills
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

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

Computational Physics Internship — 2010-2011
Nanohmics, Inc. Austin, TX
Project funded through U.S. Department of Defense, PI B. Zollars
Implemented unstructured adaptive mesh methods for finite element code to model liquid erosion of coated lenses

Skills

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