

Elizabeth Bradley
Department of Computer Science
University of Colorado
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Research Interests

Nonlinear dynamics and chaos; control theory; artificial intelligence; numerical & scientific computing.

Degrees Awarded

Ph.D. Electrical Engineering and Computer Science

Massachusetts Institute of Technology September 1992
Thesis research, under Professors G. J. Sussman and H. Abelson, combining ideas from nonlinear dynamics, artificial intelligence, and control theory in order to exploit chaotic behavior. Minor in mathematical physics: general relativity, galactic dynamics, etc.

S.M. Computer Science

Massachusetts Institute of Technology June 1986
Thesis research, under Professor R. H. Halstead, on multiprocessor applications. Advanced training in digital signal processing, VLSI, network theory and circuit design, and simulation.

S.B. Electrical Engineering

Massachusetts Institute of Technology December 1983
Broad curriculum in electrical engineering, with emphasis on analog and digital circuit design. Secondary focuses on ancient history and a variety of foreign languages.

Professional History

Professor

University of Colorado

Chair May 2003 to February 2006

Associate Professor May 1999 to May 2004

Assistant Professor January 1993 to May 1999

Department of Computer Science and Department of Electrical and Computer Engineering. Faculty affiliate with the Departments of Applied Mathematics and Mechanical Engineering. Currently supervising or co-supervising three Ph.D. theses, one B.S. thesis, and three undergraduate research students.

Radcliffe Fellow

Radcliffe Institute for Advanced Study AY2006-2007

Visiting Scholar

Harvard University Spring 1997

Division of Engineering and Applied Sciences AY1999-2000

Doctoral Candidate/Research Assistant

Massachusetts Institute of Technology 1986 to 1992

Researched and implemented computer control algorithms that exploit chaos. Designed and built physical devices to demonstrate these tools.

Honors

Women of Excellence, MIT Crew	35th Anniversary, MIT Alumni Association
CRA-W Distinguished Professor	2008
CAPP-R (Cohort of Associate Professors Project)	
Radcliffe Fellow	2006-2007
John & Mercedes Peebles Innovation in Teaching Award	1999
(The yearly student-voted College of Engineering award)	
Subaru CU Educator Spotlight Award	2002
Member of the External Faculty, Santa Fe Institute	1999-2005, 2006-2012
Packard Fellowship in Science and Engineering	1995-2000
NSF National Young Investigator Award	1993-1998
AAUW Dissertation Fellowship	1991/92 Academic Year
IEEE	Senior Member
1988 Olympic Games	5th Place, Rowing, Women's Four With Coxswain

Publications

I. Journal Papers

- R. Hoenigman, A. Lim, and E. Bradley, "Cooperation in Bike Racing: When to Work Together and When to Go It Alone," to appear, *Complexity*
- C. Zweck, M. Zreda, K. Anderson, L. Rassbach, and E. Bradley, "The theoretical basis for ACE, an Age Calculation Engine for Cosmogenic Nuclides," in review, *Chemical Geology*
- L. Rassbach, K. Anderson, and E. Bradley, "Providing Decision Support for Cosmogenic Isotope Dating," in press, *AI Magazine*. This paper is an invited, expanded version of our *IAAI-2010* paper
- E. Bradley, D. Capps, J. Luftig, and J. Stuart, "Towards Stylistic Consonance in Human Movement Synthesis," *Open AI Journal* 4:1-19 (2010)
- N. Ross, J. Hertzberg, and E. Bradley, "Discretization of the Vorticity Field of a Planar Jet," *Experiments in Fluids* 49:1161 (2010)
- T. Mytkowicz, E. Bradley, and A. Diwan, "Computers Are Dynamical Systems," *Chaos* 19, 033124 (2009); doi:10.1063/1.3187791
- T. Peacock and E. Bradley, "Going with (or Against) the Flow," *Science* 320:1302-1303 (2008)
- J. Giardino, J. Hertzberg, and E. Bradley, "A Calibration Procedure for Millimeter-Scale Stereomicroscopic Particle Image Velocimetry," *Experiments in Fluids*. DOI: 10.1007/s00348-008-0525-1. Published online 16 June 2008; www.springerlink.com/content/941k0g7k288175t4/
- R. Stolle, A. Hogan, and E. Bradley, "Agenda Control for Heterogeneous Reasoners," *Journal of Logic and Algebraic Programming* 62:41-69 (2005)
- D. Gorman, P. Gruenwald, P. Hanlon, I. Mezic, L. Waller, C. Castilla-Chavez, E. Bradley, and J. Mezic, "Implications of Systems Dynamic Models and Control Theory for Environmental Approaches to the Prevention of Alcohol- and Other Drug-Related Problems," *Substance Use and Misuse* 39:1713-1750 (2004)

- V. Robins, J. Abernethy, N. Rooney, and E. Bradley, "Topology and Intelligent Data Analysis," *Intelligent Data Analysis* **8**:505-515 (2004)
- T. Peacock, J. Hertzberg, Y-C. Lee, and E. Bradley, "Forcing a Planar Jet Flow with MEMS," *Experiments in Fluids* **37**:22-28 (2004)
- V. Robins, N. Rooney, and E. Bradley, "Topology-Based Signal Separation," *Chaos* **14**:305-316 (2004)
- Z. Ma, E. Bradley, T. Peacock, J. Hertzberg, and Y-C. Lee, "Solder-Assembled Large MEMS Flaps for Fluid Mixing," *IEEE Transactions on Advanced Packaging* **26**:268-276 (2003)
- E. Bradley and R. Mantilla, "Recurrence Plots and Unstable Periodic Orbits," *Chaos* **12**:596-600 (2002)
- E. Bradley, M. Easley, and R. Stolle, "Reasoning About Nonlinear System Identification," *Artificial Intelligence* **133**:139-188 (2001)
- V. Robins, J. Meiss, and E. Bradley, "Computing Connectedness: Disconnectedness and Discreteness," *Physica D* **139**:276-300 (2000)
- E. Bradley, A. O'Gallagher, and J. Rogers, "Global Solutions for Nonlinear Systems using Qualitative Reasoning," *Annals of Mathematics and Artificial Intelligence*, **23**:211-228 (1998)
- J. Iwanski and E. Bradley, "Recurrence Plot Analysis: To Embed or not to Embed?," *Chaos*, **8**:861-871 (1998)
- E. Bradley and J. Stuart, "Using Chaos to Generate Variations on Movement Sequences," *Chaos*, **8**:800-807 (1998)
- V. Robins, J. Meiss, and E. Bradley, "Computing Connectedness: an Exercise in Computational Topology," *Nonlinearity*, **11**:913-922 (1998)
- E. Bradley and M. Easley, "Reasoning About Sensor Data for Automated System Identification," *Intelligent Data Analysis* **2**:123-138 (1998)
- J. Dixon, E. Bradley, and Z. Popović, "Nonlinear Time-Domain Analysis of Injection-Locked Microwave MESFET Oscillators," *IEEE Transactions on Microwave Theory and Technique*, **45**:1050-1057 (1997)
- E. Bradley and R. Stolle, "Automatic Construction of Accurate Models of Physical Systems," *Annals of Mathematics and Artificial Intelligence*, **17**:1-28 (1996)
- E. Bradley and D. Straub, "Using Chaos to Improve the Capture Range of a Phase-Locked Loop: Experimental Verification," *IEEE Transactions on Circuits and Systems*, **43**:914-922 (1996)
- E. Bradley, "Autonomous Exploration and Control of Chaotic Systems," *Cybernetics and Systems*, **26**:299-319 (1995)
- E. Bradley, "Causes and Effects of Chaos," *Computers and Graphics*, **19**:755-778 (1995)
- E. Bradley, "Using Chaos to Improve the Capture Range of a Phase-Locked Loop," *IEEE Transactions on Circuits and Systems*, **40**:808-818 (1993)
- E. Bradley and F. Zhao, "Phase Space Control System Design," *IEEE Control Systems Magazine*, **13**:39-46 (1993)
- E. Bradley and R. Halstead, "Simulating Logic Circuits: A Multiprocessor Application," *International Journal of Parallel Programming*, **16**:305-338 (1987)

II. Books, Book Chapters, and Theses

- R. Stolle and E. Bradley, “Communicable Knowledge in Automated System Identification,” in *The Computational Discovery of Communicable Knowledge*, L. Todorovski and S. Dzeroski, eds., Springer 2004. [28 pages]
- M. Easley and E. Bradley, “Incorporating Engineering Formalisms into Automated Model Builders,” in *The Computational Discovery of Communicable Knowledge*, L. Todorovski and S. Dzeroski, eds. Springer, 2004. [20 pages]
- E. Bradley, “Kirchhoff’s Laws,” in A. Scott, editor, *Encyclopedia of Nonlinear Science*, Routledge, 2004. [4 pages] (ISBN: 1-57958-385-7)
- M. Berthold, H.-J. Lenz, E. Bradley, and R. Kruse, eds., *Advances in Intelligent Data Analysis*, Springer-Verlag, Berlin, 2003 [624 pages]
- R. Stolle, M. Easley, and E. Bradley, “Reasoning about Models of Nonlinear Systems,” in *Logical and Computational Aspects of Model-Based Reasoning*, L. Magnani et al., eds. Kluwer, 2002 [24 pages]
- M. Easley and E. Bradley, “Information Granulation in Automated Modeling,” in W. Pedrycz, editor, *Granular Computing: An Emerging Paradigm*, Physica-Verlag, 2001 [17 pages]
- E. Bradley, “Time-Series Analysis,” in M. Berthold and D. Hand, editors, *Intelligent Data Analysis: An Introduction*, Springer Verlag, 2000; second edition, 2003 [27 pages]
- E. Bradley, *Taming Chaotic Circuits*. Ph.D. Dissertation, 1992
- E. Bradley, *Logic Simulation on a Multiprocessor*, S.M. Dissertation, 1986

III. Refereed Conference Papers

- K. Gruchalla, M. Rast, E. Bradley, P. Minnini, “Multivariate Volume Rendering using Feature-Local Distributions,” 2011 *Eurographics/IEEE-VGTC Symposium on Visualization*, in review
- L. Rassbach, K. Anderson, and E. Bradley, “Providing Decision Support for Cosmogenic Isotope Dating,” *IAAI-10 (Proceedings of the 22nd Conference on Innovative Applications of Artificial Intelligence)*, Atlanta; July 2010
- R. Hoenigman, E. Bradley and N. Barger, “AgentScapes — Designing Water Efficient Landscapes Using Distributed Agent-based Optimization,” *GECCO-10 (Proceedings of the Genetic and Evolutionary Computation Conference)*, Portland; July 2010
- C. Phillips and E. Bradley, “Strange Beta: Chaotic Variations for Indoor Rock Climbing Route Setting,” *ICAND-10 (International Conference on Applications in Nonlinear Dynamics)*, Lake Louise; September 2010
- Z. Alexander, T. Mytkowicz, A. Diwan and E. Bradley, “Measurement and Dynamical Analysis of Computer Performance Data,” *IDA-10 (International Symposium on Intelligent Data Analysis)*, Tucson; May 2010
- L. Rassbach, K. Anderson, E. Bradley, C. Zweck and M. Zreda, “End-to-End Support for Dating Paleolandforms,” *IDA-10 (International Symposium on Intelligent Data Analysis)*, Tucson; May 2010
- A. Rubin, D. Capps, and E. Bradley, “Constructionism and Creative Movement: A Manifesto,” *Constructionism (Proceedings of the 12th European Logo Conference)*, Paris; August 2010
- K. Gruchalla, M. Rast, E. Bradley, J. Clyne, and P. Minnini, “Visualization-Driven Structural and Statistical Analysis of Turbulent Flows,” *IDA-09 (International Symposium on Intelligent Data Analysis)*, Lyon; September 2009

- L. Rassbach and E. Bradley, “Challenges in presenting argumentation results,” *QR-08 (22nd International Workshop on Qualitative Reasoning about Physical Systems)*, Boulder; June 2008
- K. Gruchalla, M. Dubin, J. Marbach, and E. Bradley, “Immersive examination of the qualitative structure of biomolecules,” *QR-08 (22nd International Workshop on Qualitative Reasoning about Physical Systems)*, Boulder; June 2008
- K. Anderson, E. Bradley, M. Zreda, L. Rassbach, C. Zweck, and E. Sheehan. “ACE: Age Calculation Engine: A Design Environment for Cosmogenic Dating Techniques.” In *ADV-COMP (Proceedings of the International Conference on Advanced Engineering Computing and Applications in Sciences)*, November 2007
- L. Rassbach, E. Bradley, K. Anderson, M. Zreda, and C. Zweck, ”Arguing about Radioisotope Dating,” *QR-07 (21st International Workshop on Qualitative Reasoning about Physical Systems)*, Aberystwyth UK; June 2007
- J. Abernethy, E. Bradley, and R. Sharman, “Qualitative Reasoning About Small-Scale Turbulence in an Operational Setting,” *QR-06 (20th International Workshop on Qualitative Reasoning about Physical Systems)*, Hanover NH; July 2006
- N. Ross, E. Bradley, and J. Hertzberg, “Dynamics-Informed Data Assimilation in a Qualitative Fluids Model,” *QR-06 (20th International Workshop on Qualitative Reasoning about Physical Systems)*, Hanover NH; July 2006
- V. Robins, J. Abernethy, N. Rooney, and E. Bradley, “Topology and Intelligent Data Analysis,” *IDA-03 (International Symposium on Intelligent Data Analysis)*, Berlin; August 2003 [9% acceptance rate; 11 pages]
- Z. Ma, T. Peacock, E. Bradley, and Y.C. Lee, “Solder-assembled MEMS flaps to enhance fluid mixing,” *ASME IMECE (International Mechanical Engineering Congress and Exposition)*, New York; November 2001 [7 pages; acceptance rate unknown]
- E. Bradley, N. Collins, and W. Kegelmeyer, “Feature Characterization in Scientific Data,” *IDA-01 (International Symposium on Intelligent Data Analysis)*, Lisbon; September 2001 [16% acceptance rate; 12 pages]
- M. Easley and E. Bradley, “Intelligent Sensor Analysis and Actuator Control,” *IDA-01 (International Symposium on Intelligent Data Analysis)*, Lisbon; September 2001 [16% acceptance rate; 10 pages]
- M. Easley and E. Bradley, “Meta-domains for Automated System Identification,” *ANNIE-00 (Smart Engineering System Design)*, St. Louis; November 2000 [7 pages; acceptance rate unknown]
- M. Easley and E. Bradley, “Generalized Physical Networks for Automated Model Building,” *IJCAI-99 (International Joint Conference on Artificial Intelligence)*, Stockholm; August 1999 [25% acceptance rate; 6 pages]
- M. Easley and E. Bradley, “Reasoning About Input-Output Modeling of Dynamical Systems,” *IDA-99 (International Symposium on Intelligent Data Analysis)*, Amsterdam; August 1999 [18% acceptance rate; 13 pages]
- M. Easley and E. Bradley, “Hybrid phase-portrait analysis in automated system identification,” *AAAI Spring Symposium on Hybrid Systems in AI*, Stanford; March 1999 [6 pages; acceptance rate unknown]
- E. Bradley, D. Capps, and A. Rubin, “Can Computers Learn to Dance?,” *IDAT-99 (International Dance and Technology)*, Tempe AZ; February 1999 [5 pages; acceptance rate unknown]

- R. Stolle and E. Bradley, “Multimodal Reasoning for Automatic Model Construction,” *AAAI-98 (National Conference on Artificial Intelligence)*, Madison WI; July 1998 [30% acceptance rate; 8 pages]
- J. Stuart and E. Bradley, “Learning the Grammar of Dance,” *ICML-98 (International Conference on Machine Learning)*, Madison WI; July 1998 [30% acceptance rate; 9 pages]
- R. Stolle and E. Bradley, “Multimodal Reasoning about Physical Systems,” *AAAI Spring Symposium on Multimodal Reasoning*; Stanford CA; March 1998. AAI Technical Report SS-98-04 [6 pages; acceptance rate unknown]
- R. Stolle and E. Bradley, “Opportunistic modeling,” *IJCAI Workshop on Engineering Problems in Qualitative Reasoning*, Nagoya Japan; August 1997 [8 pages; acceptance rate unknown]
- E. Bradley and M. Easley, “Reasoning About Sensor Data for Automated System Identification,” *IDA-97 (International Symposium on Intelligent Data Analysis)*, London UK; August 1997 [23% acceptance rate; 11 pages. Selected as one of five best papers.]
- E. Bradley, A. O’Gallagher, and J. Rogers, “Global Solutions for Nonlinear Systems using Qualitative Reasoning,” *QR-97 (International Workshop on Qualitative Reasoning about Physical Systems)*, Cortona Italy; May 1997 [42% acceptance rate; 10 pages]
- R. Stolle and E. Bradley, “A Customized Logic Paradigm for Reasoning about Models,” *QR-96 (International Workshop on Qualitative Reasoning about Physical Systems)*, Stanford Sierra Camp CA; May 1996 [10 pages; acceptance rate unknown]
- E. Bradley, “Autonomous Exploration and Control of Chaotic Systems,” *AAAI Fall Workshop on Control of the Physical World by Intelligent Agents*, New Orleans LA; November 1994 [10 pages; acceptance rate unknown]
- E. Bradley, “Automatic Construction of Accurate Models of Physical Systems,” *QR-94 (International Workshop on Qualitative Reasoning about Physical Systems)*, Nara Japan; June 1994 [26% acceptance rate; 11 pages]
- E. Bradley and F. Zhao, “Phase Space Control System Design,” *CACSD-92 (IEEE Symposium on Computer-Aided Control System Design)*, Napa CA; March 1992 [8 pages; acceptance rate unknown]
- E. Bradley, “Control Algorithms for Chaotic Systems,” *the European Conference on Algebraic Computing in Control*, Paris France; March 1991. Proceedings published in *Lecture Notes in Control and Information Sciences*, volume 165, G. Jacob and F. Lamnabhi-Lagarrigue, Eds., Springer-Verlag, December 1991 [19 pages; acceptance rate unknown]

IV. Other Papers

- E. Bradley, ed., *Projects in Chaotic Dynamics: Spring 2010*, Technical Report CU-CS (Department of Computer Science) 1066-10, 2010 [138 pages]
- J. Giardino, J. Hertzberg, and E. Bradley, “A Stereo-Microscopic Particle Image Velocimetry System,” Paper NC-001. American Physical Society, *57th Annual Meeting of the Division of Fluid Dynamics*, November 21-23, 2004 Seattle, Washington.
- M. Berthold, E. Bradley, and R. Kruse “Guest Editorial,” *Intelligent Data Analysis* 8:437-438 (2004)
- E. Bradley, *Taylor Series: Notes for CSCI3656*, Research Report on Curricula and Teaching CT005-02 (Department of Computer Science), 2002. [5 pages]

- E. Bradley, *Error in Numerical Methods: Notes for CSCI3656*, Research Report on Curricula and Teaching CT004-02 (Department of Computer Science), 2002. [6 pages]
- E. Bradley and J. Stuart, "Optimization and Human Movement," *Newsletter of the SIAM Activity Group on Optimization* **12(1)** (2001) [5 pages]
- E. Bradley, review of *The Computational Beauty of Nature* by Gary Flake, *AI Magazine* **21**:89-91 (Summer 2000) [3 pages]
- E. Bradley, *Classical Mechanics: Notes for CSCI4446/6446*, Research Report on Curricula and Teaching CT007-00 (Department of Computer Science), 1999 [17 pages]
- E. Bradley, *Numerical Solution of Differential Equations: Notes for CSCI3656*, Research Report on Curricula and Teaching CT003-98 (Department of Computer Science), 1998 [20 pages]
- E. Bradley and J. Stuart, "Using Chaos to Generate Choreographic Variations," *Fourth Experimental Chaos Conference*, Boca Raton FL; August 1997 [6 pages]
- E. Bradley and D. Straub, "Chaos as a Design Tactic: Broadening the Capture Range of the Phase-Locked Loop," *ISCAS (IEEE International Symposium on Circuits and Systems)*, Seattle WA; May 1995 [4 pages]
- E. Bradley, "Hugh Herr: Spring-Loaded Entrepreneur," *Technology Review*, May 1993 [3 pages]
- E. Bradley, "A Control Algorithm for Chaotic Physical Systems," *First Experimental Chaos Conference*, Washington D.C.; October 1991. Proceedings published by World Scientific [7 pages]

Invited Presentations

- “Computers, Chaos, and Complexity,” *CIMBposium: Bridging Disciplines: Interdisciplinary Bio-science at CU-Boulder*; November 2010
- “Chaos in Computer Performance,” *Dynamics seminar*, Department of Applied Mathematics; November 2009
- “Chaos in Computer Performance,” Microsoft Research, *PL/Systems Colloquium*; October 2009
- “Chaos in Computer Performance,” University of Washington *Department of Computer Science Colloquium*; October 2009
- “Chaos in Computer Performance,” Portland State University *Department of Computer Science Colloquium*; October 2009
- “Chaos and Control,” LAAS (France’s national lab for computer systems research) *controls seminar*; September 2009
- “The Nonlinear Dynamics of Data Assimilation,” *Maths Department Seminar*, Australian National University; July 2009
- “The Dynamics and Control of Internet Attacks,” Colorado School of Mines *Department of Computer Science Colloquium*; October 2008
- “Computers, Chaos, and Choreography,” Wellesley College *Department of Computer Science Colloquium*; October 2008
- “Dynamics, Data Assimilation, and Flow control,” **plenary lecture** at the International Conference on Complex Systems, Boston; October 2007
- “The Nonlinear Dynamics of Data Assimilation,” *Maths Department Seminar*, University of Manchester; August 2007
- “The Dynamics and Control of Internet Attacks,” Tufts University Department of Computer Science **Distinguished Lecturer**; May 2007
- “Computers, Chaos, and Choreography,” *Residence Hall Seminar Series*, Simmons Hall (MIT); April 2007
- “The Dynamics and Control of Internet Attacks,” *Santa Fe Institute Seminar*; March 2007
- “Chaos and Control,” Boston University *Computer Science Department Seminar*; March 2007
- “Chaos and Control,” Radcliffe Institute for Advanced Study, *Fellows Presentation Series*; September 2006
- “Chaos and Control,” UC Santa Cruz, *College of Engineering Seminar*; September 2006
- “The Dynamics and Control of Internet Attacks,” *US National Conference on Theoretical and Applied Mechanics (USNCTAM)*, June 2006.
- “Nonlinear Dynamics, Modeling, and the Environmental Sciences: Ideas and Tools,” UC Davis, *Advanced Modeling Concepts for Environmental Sciences Series*, December 2005.
- “Motion-Capture, Chaos, and Choreography,” *CU Dance/Math year*, April 2005.
- “Control Theory 101 for Operating Systems People,” *HotOS workshop*, Santa Fe, June 2005.
- “Adaptive Nonlinear Resource Distribution Control,” *Dynamics Colloquium*, Applied Math Department; November 2004.

- “The Nonlinear Dynamics of Flow Control,” *Dynamics Days*, Chapel Hill, NC, January 2004.
- “Chaos and Control,” Northwestern University, *Physics Department Seminar*; October 2003
- “The Nonlinear Dynamics of Flow Control,” *IMA Workshop on Bifurcations: The Use and Control of Chaos*, Southampton, U.K., July 2003.
- “Chaos and Control,” University of Colorado, Sigma Xi chapter, November 2002
- “Coherent Structure Characterization in Scientific Datasets,” NASA Ames, October 2002
- “Chaos and Control,” DARPA/ATO; December 2001
- “Computers, Chaos, and Choreography,” Tufts University, **CRA-W Distinguished Lecturer**, October 2001
- “Chaos and Control,” Duke University; October 2001
- “The Nonlinear Dynamics of Flow Control,” Gordon Research Conference on Nonlinear Dynamics; June 2001
- “Chaos and Control,” JASON Fall Meeting; November 2000
- “Chaos and Control,” Naval Research Lab; April 2000
- “Chaos and Control,” Boston University, Dynamical Systems Seminar; February 2000
- “Chaos and Control,” Cornell University, Department of Theoretical and Applied Mechanics; December 1999
- “Chaos, Computers, and Choreography,” Microsoft Research; November 1999
- “Chaos and Control,” Santa Fe Institute; February 1999
- “Chaos and Control,” University of Utah, Department of Mathematics; April 1999
- “Multimodal Reasoning about Physical Systems,” **Plenary address** at *ANNIE (Artificial Neural Networks in Engineering)*, St. Louis MO; November 1998
- “Using Chaos to Generate Choreographic Variations,” University of Colorado, College of Engineering Alumni Reunion group; May 1998.
- “Automatic Construction of Accurate Models of Physical Systems,” Northwestern University, Institute for the Learning Sciences; April 1998
- “Chaos and Control,” Colorado School of Mines, Mathematical and Computer Sciences Department; February 1998
- “Chaos and Control,” University of Colorado at Denver, *Optimization Seminar*; February 1998
- “Predictability, Chaos, and the Weather: The Butterfly’s Wings,” *Graduate School Symposium on El Niño*, University of Colorado; January 1998
- “Chaos and Control,” Colorado State University, Computer Science Department; November 1997
- “Chaos and Control,” Colorado State University, Math Department; October 1997
- “Chaos and Control,” **CICSR (Centre for Integrated Computer Systems Research) Distinguished Lecture Series**, University of British Columbia; October 1996
- “Chaos and Control,” *Annual Meeting of the Packard Fellows*, Monterey CA; September 1996
- “Using Nonlinear Dynamics to Model and Control Chaotic Systems,” University of Colorado at Denver, Physics Department; April 1995

- “Automatic Construction of Accurate Models of Physical Systems,” University of Texas, Computer Science Department; January 1995
- “Autonomous Exploration and Control of Chaotic Systems,” *AAAI (National Conference on Artificial Intelligence) Fall Workshop on Control of the Physical World by Intelligent Agents*, New Orleans LA; November 1994
- “Automatic Construction of Accurate Models of Physical Systems,” Storage Tek, Information Systems Group; May 1994
- “Chaos, Computers, and Physics,” University of Colorado at Denver, Physics Department; February 1994
- “Up and Down Using Only Back and Forth,” the annual **Alice Dickinson Lecture**, Smith College; December 1993
- “Chaos in Electronic Circuits,” University of Colorado, Electrical and Computer Engineering Department; February 1993
- “Autonomous Exploration and Control of Chaotic Systems,” Fields Institute, *Director’s Series*, Waterloo Ontario; September 1992
- “Autonomous Exploration and Control of Chaotic Systems,” University of Colorado, Computer Science Department; April 1992
- “Autonomous Exploration and Control of Chaotic Systems,” University of Minnesota, Computer Science Department; March 1992
- “Autonomous Exploration and Control of Chaotic Systems,” University of British Columbia, Computer Science Department; March 1992
- “Autonomous Exploration and Control of Chaotic Systems,” University of California, Electrical Engineering and Computer Science Department; March 1992
- “Autonomous Exploration and Control of Chaotic Systems,” University of Oregon, Computer Science Department; March 1992
- “Autonomous Exploration and Control of Chaotic Systems,” Beckman Institute, University of Illinois, March 1992
- “Autonomous Exploration and Control of Chaotic Systems,” *International Symposium on Artificial Intelligence and Mathematics*, Fort Lauderdale FL; January 1992
- “Autonomous Exploration and Control of Chaotic Systems,” *Mathematical Sciences Institute Hybrid Systems Meeting*, Ithaca, NY; June 1991

Funding History

PI University of Colorado Council on Research and Creative Work, Conference Award for graduate student travel grants to attend the *International Workshop on Qualitative Reasoning*. \$2K; 2008.

co-PI National Science Foundation contract #SMA-0720692, “CSR—SMA: Validating Architectural Simulators Using Non-Linear Dynamics Techniques.” \$577K; 2007–2011. Co-PI: A. Diwan, University of Colorado. (Plus \$12K Research Experiences for Undergraduates (REU) supplement.)

PI Dean’s Seed Grant. \$3700K; 2005.

co-PI Equipment gift from Agilent. \$18K; 2005. With Jean Hertzberg.

- co-PI** National Science Foundation ITR contract #ATM-0325812, “ITR: Collaborative Research: Software for Interpretation of Cosmogenic Isotope Inventories – A Combination of Geology, Modeling, Software Engineering and Artificial Intelligence.” \$922K; 2003–2008. One co-PI; Bradley portion \$461K
- co-PI** REU supplement to National Science Foundation ITR contract #ATM-0325812. \$30K; 2003–2008. One co-PI; Bradley portion \$15K
- PI** University of Colorado Council on Research and Creative Work Grant in Aid. “Feature Extraction from Oceanographic Datasets.” \$7K; 2002–2003
- co-PI** National Science Foundation Equipment Grant contract #CTS-0114109, “Acquisition of a Particle Image Velocimetry System.” \$83K; 2001–2002. Four co-PIs; Bradley portion \$16K
- co-PI** REU supplement to National Science Foundation ITR contract #ACI-0083004. \$30K; 2001–2003. One co-PI; Bradley portion \$15K
- lead PI** National Science Foundation ITR contract #ACI-0083004, “An Interactive Experimental/Numerical Simulation System with Applications in MEMS Design.” \$497K; 2000–2003. Three co-PIs; Bradley portion \$165K
- PI** Sandia National Laboratories contract # 0100.12.0033B, “Feature Extraction from Large Scientific Datasets.” \$167K; 2000–2002
- PI** Office of Naval Research contract #N00014-96-1-0720, “Automatic Construction of Accurate Models of Physical Systems.” \$304K; 1996–1999
- PI** Packard Fellowship in Science and Engineering, David and Lucile Packard Foundation. \$550K; 1995–2000
- PI** National Science Foundation contract #MIP-9403223, “Automatic Construction of Accurate Models of Physical Systems.” \$65K; 1994–1995
- PI** National Science Foundation National Young Investigator Award #CCR-9357740, “New Approaches to Engineering Design: Controlled Chaos and Computer Automation.” \$287K; 1993–1998
- PI** National Science Foundation Research Initiation Grant #CCR-9309556, “Automatic Construction and Refinement of Dynamic Systems Models.” Proposal accepted in 1993, but withdrawn because of NYI award

Research Mentoring

Unless otherwise noted, all are in the Department of Computer Science. ECE = Electrical and Computer Engineering.

- Postdocs
 - Thomas Peacock: fluid flow control in micromachined systems [1/98 – 12/99; now a tenured associate professor in the Mechanical Engineering Department at MIT]
- Ph.D. students
 - Jennifer Abernethy: forecast system for clear-air turbulence [Degree awarded 12/08; now at NCAR]
 - Zach Anderson: computer dynamics [Began Ph.D. 8/08]
 - Matthew Easley: automated input-output modeling of dynamical systems [Degree awarded 12/00; now at Rockwell Research]

- Joshua Garland: prediction of computer dynamics [*Began Ph.D. 10/10*]
 - James Garnett: modeling and control of computer networks [*Degree awarded 12/04; now at Secure64*]
 - Kenny Gruchalla: visualization of data from dynamical systems [*Degree awarded 12/09; now leading scientific visualization group at NREL*]
 - Rhonda Hoenigman: agent-based modeling of landscape ecology [*Began Ph.D. 8/07*]
 - Joseph Iwanski: recurrence-plot analysis of time series from dynamical systems [*ABD, Applied Mathematics; now chair of Mathematics and Computer Science at the Dwight Englewood School.*]
 - Todd Mytkowicz: nonlinear dynamics of computer performance [*Degree awarded 12/09; co-advisor with Amer Diwan; now at Microsoft Research*]
 - Laura Rassbach: artificial intelligence tools for paleoclimate dating [*Degree awarded 12/09; now in local industry*]
 - Vanessa Robins: computational topology [*Degree awarded 6/00; co-advisor with James Meiss (Applied Mathematics); now a lecturer in Maths at the Australian National University*]
 - Natalie Ross (nee Rooney): data assimilation [*Degree awarded 5/08; now at IBM*]
 - Reinhard Stolle: automated modeling of dynamical systems [*Degree awarded 8/98; now leading the Car IT group at BMW*]
 - Amos Waterland: computer performance modelling [*Began degree 9/10; co-advisor with Margo Seltzer, Harvard University*]
 - Elizabeth White: automatic detection of conflict & support statements in the medical literature [*Degree awarded 5/10; co-advisor with Larry Hunter; now a postdoc at the CU Medical School*]
- M.S. research and thesis students
 - Stephanie Boyles: feature recognition and tracking in turbulent convection data [*Degree awarded 5/06; co-advisor with Jane Mulligan; now in telecomm industry*]
 - Nancy Collins: feature recognition and tracking in turbulent convection data [*Degree awarded 12/01; now at NCAR*]
 - John Giardino: measurement of 3D microfluidics of MEMS actuators [*Degree awarded July 2004; co-advisor with Jean Hertzberg, Mechanical Engineering; now at Tennessee Valley Infrastructure Group*]
 - Stephen Heck: entropy measures for computer performance analysis [*Degree awarded 5/10; now at Sandia*]
 - Jonathan Marbach: chaos and music [*Degree awarded 8/03; went on to CU Ph.D. program*]
 - Damon McCoy: network development for coupling experimental data to numerical simulator [*Moved to CU Ph.D. program in January 2004.*]
 - Thomas Nelson: stochastic optimization using chaos and genetic algorithms [*Degree awarded 12/10; went on to CU Ph.D. program*]
 - Vanessa Robins: computational topology [*Degree awarded 1999; co-advisor with James Meiss, Applied Mathematics; went on to CU Ph.D. program*]
 - Matthew Schwieterman: nonlinear dynamics of diffusion flames [*Degree awarded 5/97; co-advisor with Jean Hertzberg, Mechanical Engineering*]

- Andrey Smirnov: feature recognition in finite element data [*Degree awarded 12/02; now at Sun Microsystems*]
- B.S. thesis students
 - Matthew Culbreth, “Extracting vortices from PIV data,” 2004-2005.
 - Mark Eret, “ n -body simulations of Saturn’s rings using a geometric decomposition strategy of parallelizing the Barnes-Hut algorithm,” 2005-2006.
 - Nikki Look, “Analysis of human gait data,” 2010-present.
- Undergraduate research projects

Ellenor Brown (at Harvard), Meenakshy Chakravorty (SMART program), Patrick Clary (DLC apprentice), Michael Conde, Math Culbreth, John Giardino, Apollo Hogan, Eric Horacek, Connor Janowiak, Asim Khwaja (now a tenured Associate Professor at the Kennedy School of Government, Harvard), Sebastian Kuzminsky, Katie Lang (CRA-W distributed mentor program student), Bryan LeMaster, Nikki Look, Jesse Negretti, John Nord, Sven Nuesken, Jonathan Olson (CU College of Engineering outstanding graduate award for research, 2008), Susan Plummer, Jeremy Ralph (DLC apprentice; won yearly best-poster prize for that group), Alex Renger, Amber Roche, Dan Santa Maria, Evan Sheehan (DLC apprentice), Eric Schell, Roscoe Schenk, Stephen Schroeder, Josh Stuart (now a tenured Associate Professor at UC Santa Cruz), Jeff Taggart, Robert Tarrall, David Trowbridge.

Professional Service

- Program chair, *Tenth International Symposium on Intelligent Data Analysis (IDA '11)*, Porto; October 2011
- Publicity chair, *Ninth International Symposium on Intelligent Data Analysis (IDA '10)*, Tucson; May 2010
- Science Board, Santa Fe Institute, Fall 2008–present
- External Advisory Board, NSF ADVANCE grants at the University of Colorado (2005–2009) and Brown University (2007–2010)
- External Advisory Board, NSF grant “Potential Recruits to Engineering,” Margaret Eisenhart, PI (2006–2009)
- Editor, *Chaos* (the American Institute of Physics’s interdisciplinary journal of nonlinear science), 2004–present
- Mentor, CRA’s *CAPP-R (Cohort of Associate Professors Project)*, Fall 2008
- Program co-Chair, *International Workshop on Qualitative Reasoning*, June 2008
- Program co-Chair, *Dynamics Days*, January 2007
- Advisory Board, *Chaos*, 1998–2004
- Reviewer, NSF Grad Fellowship Program, December 2004
- Panelist, NSF EHS ITR review, March 2003; NSF DMS panel, Feb 2006.
- Panelist, National Institute for Alcoholism and Alcohol Abuse (NIAAA) planning workshop, Berkeley, October 2002. (DARPA-esque “future directions for the agency” event. A 2004 journal publication grew out of this meeting.)
- Editorial Board, Santa Fe Institute, 2002–present

- Panelist, Department of Defense IS&T TARA, Rome N.Y., March 2000.
- Program chair, *Fifth International Symposium on Intelligent Data Analysis (IDA '03)*, Berlin; August 2003.
- Publicity chair, *Ninth International Symposium on Intelligent Data Analysis (IDA '03)*, Tucson; May 2010.
- Organizing Committee, *Smart Engineering System Design (ANNIE '99)*, St. Louis MO; November 1999.
- Associate Editor of the *Annals of Mathematics of Artificial Intelligence*, special issue on “Reasoning About Functional Models,” 1996.
- Program committees for *AAAI (National Conference on Artificial Intelligence)* 1996, 1997, 2010, 2011; *QR (International Workshop on Qualitative Reasoning)* 1999, 2000, 2006, 2007, 2008, 2009; *IDA (International Symposium on Intelligent Data Analysis)* 1999, 2001, 2003, 2009, 2010, 2011; *Dynamics Days* 2006, 2008
- Steering committee, *Intelligent Data Analysis*: semiannual journal and biannual symposium, 1999–2003; 2009–present
- Referee for *Artificial Intelligence, Information Processing Letters, International Journal of Parallel Programming, Consciousness & Cognition, Cognitive Science, IEEE Control Systems Magazine, Chaos, IEEE Transactions on Automatic Control, Physica D, the IEEE American Control Conference, IEEE Transactions on Circuits and Systems, Computers and Electrical Engineering, Physical Review, Physical Review Letters, Physics Letters A, Geophysical Research Letters*, and the International (*IJCAI*) and National (*AAAI*) conferences on Artificial Intelligence, as well as the international workshops on qualitative reasoning (*QR*) and intelligent data analysis (*IDA*). Proposal reviewer for the Radcliffe Institute, the National Science Foundation, the US Geological Survey, and the University of Colorado’s internal Packard Fellow competition.
- Athlete Mentor, US Olympic Committee, 1999–present.
- Board Member and Faculty Advisor, CU Crew Team, 1999–2003.
- Consistently involved in research fairs, industrial liason activities, and the planning and execution of other events designed to encourage high-school, women, and minority students in their pursuit of science and engineering, including:
 - Successfully identifying, nominating, and mentoring women and minority students for fellowships, awards, and scholarships: Sheryl Young Scholarship; Francis Stribic Fellowship; Catawba Nation Scholarship; Santa Fe Institute Summer School Fellowship; CU Chancellor’s Fellowship, etc.
 - Organizing social/networking gatherings for women graduate students, in the CS department and elsewhere on campus
 - Giving seminars for various graduate student groups on how to find academic jobs, put together good presentations, etc.
 - Participating in Women in Engineering Program (WIEP) events for women students in two Departments (CS and ECE), as well as in the College at large
 - Giving WIEP high-school *Career Days*, Society of Women Engineers (SWE), and Eta Kappa Nu (HKN) presentations
 - Acting as departmental liason for the *Careers for Women in Computing* documentary
 - Participating in women/science events in the Boulder community