

W. Christopher Strickland

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EDUCATION

Ph.D. in Mathematics December 2013
Colorado State University, Fort Collins, CO
Advisers: Profs. Gerhard Dangelmayr & Patrick Shipman
Dissertation title: The Mathematical Modeling and Analysis of Nonlocal Ecological Invasions and Savanna Population Dynamics (defended 10-16-2013)

M.S. in Mathematics August 2007
University of Florida, Gainesville, FL
Adviser: Prof. Philip Boyland
Thesis title: Bifurcations of the Degree-Two Standard Family of Circle Maps

B.S. in Mathematics and B.A. in French, minor in physics, *summa cum laude* May 2005
University of Mississippi, Oxford, MS
Sally McDonnell Barksdale Honors College Graduate
Honors thesis: Mind, Gödel, and the Incompleteness of Human Thought

PROFESSIONAL APPOINTMENTS

Associate Professor August 2023-Present
Assistant Professor August 2017-July 2023
University of Tennessee, Knoxville
Department of Mathematics & adjunct in Department of Ecology and Evolutionary Biology

Postdoctoral Researcher, Joint Appointment August 2014-July 2017
Statistical and Applied Mathematical Sciences Institute (SAMSI) (Aug. 2014 – July 2016), and
University of North Carolina, Chapel Hill, Department of Mathematics
Postdoctoral mentors: Profs. Laura Miller & Richard Smith
Research under the Program on Mathematical and Statistical Ecology involving dispersal dynamics, tipping points, and savanna structure. Helped lead collaborations spanning over six fields of science and mathematics and teams of up to twelve researchers.
Mentor and supervisor for three undergraduate students working on various research projects.

AREAS OF INTEREST

Mathematical & Probabilistic Modeling/Simulation
Mathematical Biology
Dispersal Ecology

Complex Systems
Scientific Computing
Dynamical Systems

PUBLICATIONS

1. Elzinga, D., Beckford, C., Strickland, W.C. (2023). A mathematical model of the impacts of climate change on the winter tick epizootic in moose. *Ecological Modelling*, 483, 110421.
2. Gross, L.J., McCord, R.P., LoRe, S., Ganusov, V.V., Hong, T., Strickland, W.C., Talmy, D., von Arnim, A.G., Wiggins, G. (2023). Prioritization of the concepts and skills in quantitative education for graduate students in biomedical science. *PLOS ONE*, 18, 1-12.
3. Hamlet, C., Strickland, W.C., Battista, N., Miller, L.A. (2023). Multiscale flow between the branches and polyps of gorgonians, *Journal of Experimental Biology*, 266(5): jeb244520.
4. Phillips, T., Gaoue, O.G., Lenhart, S, Strickland W.C. (2023). Modeling the effects of size-dependent harvesting strategies on the population dynamics of tropical trees. *Mathematical Biosciences*, 355, 108953.
5. Strickland, W.C., Battista, N.A., Hamlet, C.L., Miller, L.A. (2022). Planktos: An agent-based modeling framework for small organism movement and dispersal in a fluid environment with immersed structures. *Bulletin of Mathematical Biology*, 84(72).
6. Smith, K.V., DeLong, K.L, Boyer, C.N., Thompson, J.M., Lenhart, S.M., Strickland, W.C., Burgess, E.R., Tian, Y., Talley, J., Machtinger, E.T., Trout Fryxell, R.T. (2022). A call for the development of a sustainable pest management program for the economically important pest flies of livestock: a beef cattle perspective. *Journal of Integrated Pest Management*, 13(1), 14.
7. Phillips, T., Lenhart, S., Strickland, W.C. (2021). A data-driven mathematical model of the heroin and fentanyl epidemic in Tennessee. *Bulletin of Mathematical Biology*, 83(97).
8. Senter, M., Douglas, D.R., Strickland, W.C., Thomas, S., Talkington, A., Miller, L.A., Battista, N.A. (2020). A semi-automated finite difference mesh creation method for use with immersed boundary software including IB2d and IBAMR. *Bioinspiration & Biomimetics*, 16, 016008.
9. Bernoff, A.J., Culshaw-Maurer, M., Everett, R.A., Hohn, M., Strickland, W.C., Weinburd, J. (2020). Agent-based and continuous models of hopper bands for the Australian plague locust: How resource consumption can mediate pulse formation and geometry, *PLOS Comp. Bio.*, 16(5), e1007820.
10. Ozalp, K., Miller, L., Dombrowski, T., Braye, M., Dix, T., Pongracz, L., Howell, R., Klotsa, D., Pasour, V., Strickland, W.C. (2020). Experiments and agent based models of zooplankton movement within complex flow environments, *Biomimetics*, 5(1), 2.
11. Beckman, N.G., Aslan, C.E., Rogers, H.R., Kogan, O., Bronstein, J.L., Bullock, J.M., Hartig, F., HilleRisLambers, J., Zhou, Y., Zurrell, D., Brodie, J.F., Bruna, E.M., Cantrell, S.R., Decker, R., Effiom, E.O., Fricke, E.C., Gurski, K., Hastings, A., Johnson, J., Loiselle, B.A., Miriti, M.N., Neubert, M.G., Pejchar, L., Poulsen, J.R., Pufal, G., Razafindratsima, O.H., Sandor, M., Shea, K., Schreiber, S.J., Schupp, E.W., Snell, R.S., Strickland, C., Zambrano, J. (2019). Advancing an interdisciplinary framework to study seed dispersal ecology, *AoB Plants*, plz048.
12. Rogers, H., Beckman, N., Hartig, F., Johnson, J.S., Pufal, G., Shea, K., Zurell, D., Bullock, J.M., Cantrell, R.S., Loiselle, B., Pejchar, L., Razafindratsima, O.H., Sandor, M., Schupp, E.W., Strickland, C., Zambrano, J. (2019). The total dispersal kernel: a review and future directions, *AoB Plants*, plz042.
13. Battista, N.A., Percy, L.B., Strickland, W.C. (2019). Modeling the prescription opioid epidemic, *Bulletin of Mathematical Biology*, 81(7), 2258-2289.
14. Aslan, C.E., Beckman, N.G., Rogers, H., Bronstein, J., Zurell, D., Hartig, F., Shea, K., Pejchar, L., Neubert, M., Poulsen, J., HilleRisLambers, J., Miriti, M., Loiselle, B., Effiom, E., Zambrano, J., Schupp, E., Pufal, G., Johnson, J., Bullock, J., Brodie, J., Bruna, E., Cantrell, S., Decker, R., Fricke, E., Gurski, K., Hastings, A., Kogan, O., Razafindratsima, O., Sandor, M., Schreiber, S., Snell, R., Strickland, C., Zhou, Y. (2019). Employing plant functional groups to advance seed dispersal ecology and conservation, *AoB Plants*, 11(2), plz006.
15. Snell, R.S., Beckman, N.G., Fricke, E., Loiselle, B., Carvalho, C., Jones, L., Lichti, N., Lustenhouwer, N., Schreiber, S., Strickland, C., Sullivan, L., Cavazos, B., Giladi, I., Hastings, A.,

- Holbrook, K., Jongejans, E., Kogan, O., Montano-Centellas, F., Rudolph, J., Rogers, H., Zwolak, R., Schupp, E. (2019). Consequences of intraspecific variation in seed dispersal for plant demography, communities, evolution, and global change, *AoB Plants*, 11(4), plz016.
16. Battista, N., Strickland, C., Barrett, A., Miller, L.A. (2018). IB2d Reloaded: an updated Python and MATLAB implementation of the immersed boundary method, *Mathematical Methods in the Applied Sciences*, 41(18), 8455-8480.
 17. Strickland, C., Miller, L.A., Santhanakrishnan, A., Hamlet, C., Battista, N.A., Pasour, V. (2017). Three-dimensional low Reynolds number flows near biological filtering and protective layers, *Fluids*, 2(62).
 18. Strickland, C., Kristensen, N.P., Miller, L.A. (2017). Inferring stratified parasitoid dispersal mechanisms and parameters from coarse data using mathematical and Bayesian methods, *Royal Society Interface*, 14(130), 20170005.
 19. Strickland, C., Pearson, D.A., Shipman, P.D. (2017). Formation of square lattices in coupled pattern-forming systems. *BIOMATH*, 5(2), 1612181.
 20. Battista, N., Strickland, C., Miller, L.A. (2017). IB2d: A Python and MATLAB implementation of the immersed boundary method. *Bioinspiration & Biomimetics*, 12(3), 036003.
 21. Strickland, C., Liedloff, A., Cook, G.D., Dangelmayr, G., Shipman, P.D. (2016). The role of water and fire in driving tree dynamics in Australian savannas. *Journal of Ecology*, 104(3), 828-840.
 22. Strickland, C., Dangelmayr, G., Shipman, P.D., Kumar, S., Stohlgren, T.J. (2015). Network spread of invasive species and infectious diseases, *Ecological Modelling*, 309-310, 1-9.
 23. Strickland, C., Dangelmayr, G., Shipman, P. (2014). Modeling the presence probability of invasive plant species with nonlocal dispersal, *Journal of Mathematical Biology*, 69(2), 267-294.
 24. Shipman, P.D., Faria, S.H., Strickland, C. (2013). Towards a continuous population model for natural language vowel shift, *Journal of Theoretical Biology*, 332, 123-135.

UPCOMING PUBLICATIONS

- Elzinga, D.C., Strickland W.C. Generalized stressors on social bee colonies. Submitted.
- Pearcy, L., Lenhart, S., Strickland, W.C. Structural instability and linear allocation control in models of substance use disorder. Submitted.
- Pearcy, L.B., Queen, O., Jodoin, V., Strickland, W.C. Agent-based dynamics of a SPAHR opioid model on social network structures. In preparation.

GRANTS, HONORS & AWARDS

- Oak Ridge National Lab (Prime Sponsor: U.S. Department of Veterans Affairs).** *Quantifying Environmental Factors for Opioid Use Disorder*. PI (\$271,634, \$458,453 total UTK), February 2023 - June 2024.
- NSF-DMS Mathematical Biology. *Collaborative Research: RUI: The fluid dynamics of organisms filtering particles at the mesoscale*. PI (\$199,685 UTK, approx. \$500,000 total), 2023-2026, submitted.
- HHS-NIH-NIAMS P30 *National Institute of Arthritis and Musculoskeletal and Skin Diseases*. Co-PI, April 2024 – March 2029, Submitted.
- American Institute of Mathematics, SQuaREs (Structured Quartet Research Ensembles). Funded for a week-long collaborative visit at AIM (approx. \$3000 per year), 2023-2025.
- Auburn University (Prime Sponsor: NSF).** *NSF INCLUDES Alliance: The Alliance of Students with Disabilities for Inclusion, Networking, and Transition Opportunities in STEM (TAPDINTO-STEM)*. Co-PI (\$237,122), 2021-2026.
- Simons Foundation.** *Collaboration Grant for Mathematicians*, PI (\$42,000), 2018-2023.
- Contract work: *Consulting services relating to population modeling with potential connections to the homeless population of Houston, TX*. PI (\$5,000), 2020-2023.

Burroughs Wellcome Fund. *Enhancing Quantitative and Data Science Education for Graduate Students in Biomedical Science, Senior Personnel* (\$149,823), 2018-2020.

National Institute for Mathematical and Biological Synthesis (NIMBioS) short-term visitor proposal.

Foraging and Social Interaction in the Formation of Locust Hopper Bands, funded for a four-day, collaborative research visit (approx. \$6,100), 2020.

Institute for Advanced Study (IAS) Summer Collaborators Program. Research program chosen for funding by the School of Mathematics for a two-week collaborative visit of six people, 2019.

Selected and funded participant in the AMS Mathematics Research Community: Agent-based Modeling in Biological and Social Systems, 2018-2019.

Cross Disciplinary Prize Winner, International Conference on Mathematical Methods and Models 2015. Yates Summer Graduate Fellowship, 2013.

Summer Graduate Research Assistantship (competitive), CSU Mathematics Department, 2011.

Center for Interdisciplinary Mathematics and Statistics (Colorado State University) Fellowship, 2009.

Honors Societies: Phi Beta Kappa, Phi Kappa Phi, others

COMPUTER SKILLS

Primary languages: Python (10+ yrs.) including NumPy, SciPy, Matplotlib, Cython, PyCUDA, Pandas, NetworkX, multiprocessing, Pytest, Pillow, PyMC, VTK/PyVista, and many more. MATLAB (10+ yrs.), Git, and LaTeX incl. BibTeX. See <https://github.com/mountainindust> for examples.

Intermediate knowledge of Photoshop and VisIt. Some exposure to C/C++, Unix, Mathematica, HTML, and IBAMR. Self-taught almost all computer skills, including MATLAB, Python, and Git. Other software experience includes Acrobat, Beamer, digital audio editing, MS Office.

TEACHING EXPERIENCE

Assistant & Associate Professor, University of Tennessee, Knoxville Aug. 2017-Present
Instructor of record for Honors Calc 2 & 3, Differential Equations, Honors Intro. to Abstract Math, Mathematical Ecology I & II (grad), Models in Biology, Readings in Mathematics, Adv. Math Ecology (grad), Mathematics for the Life Sciences I, Mathematical Biology seminar

Postdoctoral Lecturer, University of North Carolina, Chapel Hill Aug.-Dec. 2015 & 2016
Instructor of record for a senior undergrad course on mathematical modeling (25 students). Duties include supervising a graduate teaching assistant and a university funded graduate research consultant.

Instructor of record for Introduction to Ordinary Differential Equations (55 students).

Mentor and supervisor for an undergraduate student working on research projects (April-Present).

Instructor, Colorado State University January-May 2014
Instructor of record for Calculus for Biologists I and Calculus for Business Majors (200 students)

Graduate Teaching Assistant, Colorado State University Jan.-May 2009 & Jan. 2010-Dec. 2013
Instructor of record for Calculus for Biologists II (3 semesters), a course which covers linear algebra, multivariable calculus, and differential equations; Introduction to Ordinary Differential Eqns (3 semesters); Calculus for Biologists I; and Calculus for Scientists and Engineers I.

Adjunct Faculty, Santa Fe College January-June 2008
Instructor of record for classes of approx. 30 students in Survey of Calculus and College Algebra.

Teaching Assistant, University of Florida August 2005-August 2007
Lectured Survey of Calculus and held discussion class for Survey of Calculus, Pre-Calculus, College Algebra, and Liberal Arts Mathematics.

STUDENT MENTORING

Ryan Campbell, UTK. PhD advisor

Feb. 2022-Present

Kimberly Eversman, UTK. PhD advisor

Sept. 2021-Present

Leigh Percy, UTK. PhD Mathematics, MS in Statistics (postdoc, U Pittsburg)	Jan. 2020-Aug. 2023
David Elzinga, UTK. PhD Mathematics, MS in Statistics (TTF at UW LaCrosse)	Jan. 2020-May 2023
Owen Queen, UTK. Undergraduate research (gap year)	Jan. 2020-May 2022
Vincent Jodoin, UTK. Undergraduate research (Grad School, Univ. Kentucky)	Jan. 2020-July 2020
Tricia Phillips, UTK. PhD co-advisor (TTF at Birmingham-Southern Univ.)	Oct. 2017-July 2020
James Zak, UNC-CH. Honors thesis advisor, indep. study (industry, KPMG)	Jan. 2017-May 2018
Leigh Percy, UNC-CH. Independent study, Directed Exploration in Math	Jan. 2017-May 2018
Ao Zeng, UNC-CH. Independent study (Grad School, Carnegie Mellon)	April 2016-June 2017

INVITED CONFERENCES, WORKSHOPS, & SEMINARS

Virginia Tech, Mathematical Biology Seminar Invited seminar: <i>Using mechanistic models to advance theory in opioid use disorder epidemiology</i>	November 2022
Auburn University, Applied Math Seminar Invited seminar: <i>Using mechanistic models to advance theory in opioid use disorder epidemiology</i>	October 2022
SIAM Life Sciences Minisymposium organizer: <i>Novel Approaches in Compartmental Models of Disease</i>	July 2022
ORNL Biostatistics and Multiscale Modelling Seminar Invited seminar: <i>Using mechanistic models to advance theory in opioid use disorder epidemiology</i>	June 2022
Workshop meeting of the MRC Locust Group (funded by Harvey Mudd College)	May 2022
Southeast Center for Mathematics and Biology Invited undergraduate seminar: <i>Locusts, plankton, and opioid use: examples of agent-based modeling in mathematical biology</i>	June 2021
International Cassiopea Workshop Invited talk: <i>Introducing Planktos: an agent-based modeling framework for small organisms in fluid flow</i>	May 2021
Center for Quantitative Medicine at UConn Health Invited seminar: <i>Using mechanistic models to advance theory in opioid addiction epidemiology</i>	February 2021
Joint Mathematics Meetings Invited talk: <i>Using agent-based models to explore network dynamics in addiction epidemiology</i>	January 2021
NIMBioS workshop meeting of the MRC Locust Group	December 2020
University of Arizona Invited seminar: <i>Modeling the prescription opioid epidemic</i>	November 2020
Claremont Center for the Mathematical Sciences Invited colloquium: <i>Modeling the prescription opioid epidemic</i> Invited seminar: <i>Approaches to modeling dispersal and swarm behavior at multiple scales</i>	March 2020
Joint Mathematics Meetings Invited talk: <i>Agent-based and continuous models of locust hopper bands</i>	January 2020
The 11 th Annual Undergraduate Research Conference at the Interface of Biology and Mathematics Invited, plenary talk: <i>Bugs and drugs: two approaches to modeling systems with social impact in mathematical biology</i>	November 2019
AMS Fall Southeastern Sectional Meeting Invited talk: <i>Modeling the prescription opioid epidemic</i>	November 2019
Society for Mathematical Biology Annual Meeting, Montreal Canada Mini-symposium organizer: <i>Agent-based models in mathematical biology</i> Invited talk: <i>Modeling movement and persistence of small organisms in flow</i>	July 2019

SIAM Conference on Applications of Dynamical Systems	May 2019
Invited talk: <i>Modeling movement, invasion, and persistence of small organisms in flow</i>	
SIAM Mathematics of Planet Earth, 2018	September 2018
Invited talk: <i>Modeling the opioid epidemic</i>	
Society for Mathematical Biology Annual Meeting, Sydney Australia	July 2018
Invited talk: <i>Flow and movement of organisms through protective layers</i>	
AMS MRC: Agent-based Modeling in Biological and Social Systems	June 2018
Invited and fully funded participant, career panelist	
SIAM-SEAS Annual Meeting, 2018	March 2018
Invited talk: <i>Modeling the opioid epidemic</i>	
SIAM Student Chapter Colloquium, Colorado State University	February 2018
Invited talk: <i>Modeling invasive dispersal at multiple scales</i>	
National Socio-Environmental Synthesis Center (SESYNC):	May 2016
Seed Dispersal Workshop (participant, fully funded)	
Modern Math Workshop and SACNAS annual meeting	October 2015
Invited talk as SAMSI postdoctoral representative: <i>A stochastically driven model for savanna water resource dynamics</i>	
SIAM Conference on Applications of Dynamical Systems	May 2015
Mini-symposium co-organizer: <i>Dynamics on networks and network topology in ecology and epidemiology</i>	
Invited talk: <i>Network spread and control of invasive species and infectious diseases</i>	
SAMSI Transition Workshop	May 2015
Invited talk: <i>Modeling dispersal patterns of parasitoid wasps</i>	
International Conference on Advances in Interdisciplinary Statistics and Combinatorics	October 2014
Invited talk: <i>Modeling savanna water resource dynamics with stochastic daily rainfall</i>	
AMS 2012 Fall Western Section Meeting	October 2012
Invited talk: <i>Modeling the nonlocal dispersal of invasive species</i>	

OTHER PRESENTATIONS AND WORKSHOPS

Society for Integrative and Comparative Biology (SICB) Annual Meeting	January 2023
Contributed talk: <i>Planktos: an agent-based framework for small organisms in fluid and around structures at the meter scale</i>	
SIAM Life Sciences	July 2022
Contributed talk: <i>Planktos: An Agent-Based Modeling Framework for Small Organisms in Fluid and Around Structures</i>	
Governor's School Math Open House, UTK	June 2021
Invited high-school seminar: <i>Locusts, plankton, and opioid use: examples of agent-based modeling in mathematical biology</i>	
Dynamics Days US 2018	January 2018
Contributed poster: <i>Modeling the opioid epidemic</i>	
BIOMATH 2017: Kruger National Park, South Africa	June 2017
Contributed talk: <i>Modelling the spread of parasitoid wasps from point release</i>	
Joint Mathematics Meetings	January 2017
Contributed talk: <i>Modelling the spread of parasitoid wasps from point release</i>	
69 th Annual Meeting of The APS Division of Fluid Dynamics	November 2016
Contributed talk: <i>Low Reynolds number flow near tiny leaves, stems, and trichomes</i>	
ECMTB/SMB Annual Meeting, Nottingham UK	July 2016
Contributed talk: <i>Modelling the spread of parasitoid wasps from point release</i>	
Society for Experimental Biology Annual Meeting, Brighton UK	July 2016
Contributed talk: <i>Modelling the spread of parasitoid wasps from point release</i>	

BIOMATH 2015: International conference on Mathematical Methods and Models in Biosciences and Young Scientists School Winner of the Cross Disciplinary Prize for the contributed talk: <i>A stochastically driven model for savanna water resource dynamics</i>	June 2015
SAMSI: Developing, Maintaining, and Employing Large Computational Frameworks for the Ecological Sciences	April 2015
SAMSI: Multivariate Models in Ecology (attended)	March 2015
Society for Integrative and Comparative Biology SouthEast Regional Meeting Contributed talk: <i>A mathematical model for savanna water resource dynamics</i>	October 2014
SAMSI Opening Workshop (attended)	August 2014
2013 Annual Conference & Meeting for the Society for Mathematical Biology Contributed talk: <i>Modeling non-local invasive spread on continuous domains coupled with a vector-based transportation network</i>	June 2013
Joint Mathematics Meetings Contributed talk: <i>Modeling the nonlocal spread of invasive plant species in heterogeneous landscapes</i>	January 2013
The 9 th AIMS Conference on Dynamical Systems, Differential Equations and Apps. Contributed talk: <i>Modeling the nonlocal dispersal of invasive species</i>	July 2012
Nonlocal PDEs, Variational Problems and their Applications, Poster Presentation: <i>Modeling the nonlocal dispersal of invasive plant species</i>	Feb. 2011
SIAM Student Workshop: Introductory Matlab Series Seminar Talk: <i>Parallel Programming Using MatlabMPI</i> Seminar Talk: <i>Object-Oriented Programming (in Matlab)</i>	Oct. & Nov. 2011

EXTENDED RESEARCH VISITS

CSIRO Darwin laboratory: Berrimah, Australia Research: Analyzed and restructured the FLAMES model for Australian savanna ecosystems	June-August 2011
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LANGUAGE SKILLS

Conversational French, Basic Spanish

SERVICE & OUTREACH

• Course Cluster: Mathematical Biology chair	Fall 2021-Present
• First-year graduate student advising	Summer 2021-Present
• MS committee member, Hoa Thieu Ly (Wally)	Summer 2022
• Assistantship & Graduate Admissions Committee	Spring 2022
• PhD committee member, Wencil Mackenzie	Spring 2022
• MS committee member, Guilherme Silva	Spring 2022
• MS committee member, Kyla Linn	Fall 2019-Spring 2022
• Honors Day Committee (Chair 2020-22)	2018-2022
• Advisory Committee	Fall 2019-Spring 2021
• PhD committee member, Mohammed Al-Mamun	Spring 2020-Summer 2021
• PhD committee member, Hannah Thompson	Spring 2021
• PhD committee member, Danielle Burton	Summer 2020
• Colloquium Committee, (Chair Fall 2019-20)	Fall 2018-Spring 2020
• PhD committee member, Le Yin	Fall 2018-Spring 2020
• PhD committee member, Logan Perry	Spring 2019

- IDP data science concentration steering committee, member Fall 2019
- Allen Medal Committee (Chair 2019) 2018-2019
- NSF Panelist Spring 2018
- Prospective Undergraduate Liaison Fall 2017-Spring 2019
- SAMSI Undergraduate Workshop, Lead Organizer May 2015
- Mathematica Demonstration Programmer Summer 2010 and Fall 2012
Developed teaching demos for Bio Calc I and an undergraduate geology course
- Incoming Graduate Teaching Assistant Mentor Fall 2012
Responsible for supervision/performance review of first year graduate teaching assistant
- iGEM Mentor, Colorado State University June-August 2012
Undergrad math mentor for the International Genetically Engineered Machine competition
- Vice President, SIAM Colorado State University Student Chapter August 2011-June 2012
VP accomplishments include a trip to the Google Boulder office and a MATLAB workshop.
- Volunteer, Department of Mathematics Math Day, Colorado State University 2009-2013

MEMBERSHIPS

Society for Mathematical Biology

Society for Industrial and Applied Mathematics (SIAM)