

ZAHRA AMINZARE

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EMPLOYMENT

- Associate Professor, Department of Mathematics, University of Iowa, since July 2024
- Assistant Professor, Department of Mathematics, University of Iowa, July 2018 –June 2024
- Postdoctoral Research Associate, PACM, Princeton University, May 2015–July 2018

OTHER APPOINTMENTS

- Faculty of The Interdisciplinary Graduate Program in Neuroscience, U. Iowa, Spring 2020–
- Member of The Iowa Neuroscience Institute, Fall 2019–
- Faculty of AMCS, U. Iowa, Spring 2019–
- Lecturer, Department of Mathematics, Princeton University, Fall 2017
- Lecturer, Department of Mechanical and Aerospace Engineering, Princeton U., Spring & Fall 2016

EDUCATION

- Ph.D. Mathematics, Rutgers University, 2009 – 2015
 - Thesis advisor: Professor **Eduardo D. Sontag**
 - Thesis title: On Synchronous Behavior in Complex Nonlinear Dynamical Systems
- B.Sc. Mathematics, Sharif University of Technology, Tehran, Iran, 2002–2007

PUBLICATIONS

Articles in journals

1. **Z. Aminzare** and A. Kay. Mathematical modeling of intracellular osmolarity & cell volume stabilization: the Donnan effect & ion transport. *J General Physiology*, 156 (8): e202413554, 2024.
2. **Z. Aminzare** and V. Srivastava. Stochastic synchronization in nonlinear network systems driven by intrinsic and coupling noise. *Biological Cybernetics*, volume 116, pages 147–162, 2022.
3. **Z. Aminzare.** Stochastic logarithmic Lipschitz constants: A tool to analyze contractivity of stochastic differential equations. *IEEE Control Systems Letters*, vol. 6, 2311–2316, 2022.
4. J. Park and **Z. Aminzare.** A mathematical description of bacterial chemotaxis in response to two stimuli. *Bull Math Biol*, 84(9), 2021. (35 pages).
5. **Z. Aminzare** and P. Holmes. Heterogeneous inputs to central pattern generators can shape insect gaits. *SIAM J. on Applied Dynamical Systems*, 18(2), 1037–1059, 2019.
6. E. Davison, **Z. Aminzare**, B. Dey, & N. Ehrich Leonard. Mixed mode oscillations and phase locking in coupled FitzHugh-Nagumo model neurons. *Chaos: An Interdisciplinary Journal of Nonlinear Science*, 29(3): 033105, 2019.
7. **Z. Aminzare**, B. Dey, E. Davison, & N. Ehrich Leonard. Cluster synchronization of diffusively coupled nonlinear systems: A contraction based approach. *J. of Nonlinear Science*, 1–23, 2018.
8. **Z. Aminzare**, V. Srivastava, and P. Holmes. Gait transitions in a phase oscillator model of insect central pattern generators. *SIAM J. on Applied Dynamical Systems*, 17(1): 626–671, 2018.

9. F. Menolascina, R. Rusconi, V. I. Fernandez, S. P. Smriga, **Z. Aminzare**, E. Sontag, and R. Stocker. Logarithmic sensing in *Bacillus subtilis* aerotaxis. *Nature Systems Biology and Applications*, 3:16036-, 2017.
10. **Z. Aminzare** and E. Sontag. Some remarks on spatial uniformity of solutions of reaction-diffusion PDEs. *Nonlinear Analysis: Theory, Methods and Applications*, 147:125–144, 2016.
11. **Z. Aminzare** and E. Sontag. Synchronization of diffusively-connected nonlinear systems: results based on contractions with respect to general norms. *IEEE Transactions on Network Science and Engineering*, 1(2): 91–106, 2014.
12. **Z. Aminzare** and E. Sontag. Logarithmic Lipschitz norms and diffusion-induced instability. *Nonlinear Analysis: Theory, Methods and Applications*, 83:31–49, 2013.

Book chapters

13. J. L. Gevertz, **Z. Aminzare**, Kerri-Ann Norton, J. Pérez-Velázquez, A. Volkening, K. A. Rejniak. Emergence of Anti-Cancer Drug Resistance: Exploring the Importance of the Microenvironmental Niche via a Spatial Model. In A. Radunskaya and T. Jackson, editors, *Applications of Dynamical Systems in Biology and Medicine*, IMA Volumes in Mathematics and its Applications. 158:1–34. Springer-Verlag, 2015.
14. **Z. Aminzare**, Y. Shafi, M. Arcak, and E. Sontag. Guaranteeing spatial uniformity in reaction-diffusion systems using weighted L^2 norm contractions. In V. Kulkarni, K. Raman, and G.-B. Stan, editors, *A Systems Theoretic Approach to Systems and Synthetic Biology I: Models and System Characterizations*, pages 73–101. Springer-Verlag, 2014.

Conference articles

15. **Z. Aminzare**, P. Holmes, and V. Srivastava. On phase reduction and time period of noisy oscillators. In *Proc. IEEE Conf. Decision and Control*, Nice, France, p 4717–4722, 2019.
16. **Z. Aminzare** and E. Sontag. Contraction methods for nonlinear systems: A brief introduction and some open problems. *IEEE Conf. Decision and Control*, Los Angeles, p 3835–3847, 2014.
17. **Z. Aminzare** and E. Sontag. Remarks on diffusive-link synchronization using non-Hilbert logarithmic norms. In *Proc. IEEE Conf. Decision and Control*, Los Angeles, p 6086–6091, 2014.
18. Y. Shafi, **Z. Aminzare**, M. Arcak, & E. Sontag. Spatial uniformity in diffusively-coupled systems using weighted L^2 norm contractions. In *Proc. American Control Conf.*, p 5639–5644, 2013.

Internal reports

19. **Z. Aminzare** and V. Srivastava. Phase reduction and synchronization of coupled noisy oscillators, arXiv:3638491.
20. **Z. Aminzare** and E. D. Sontag. Remarks on a population-level model of chemotaxis: advection-diffusion approximation and simulations. Technical report, arXiv: 1302.2605, 2013.

GRANTS

- Simons Foundation: Travel Support for Mathematicians, PI, 2024–2029 (\$42,000)
- NSF standard grant IOS-2037828, co-PI, (with A. Kay & D. Eberl from Biology), 2021–2024 (\$750,000)
 - Measuring and Mathematically Modeling Ionic Transport in Auditory Systems
 - Role: Lead Mathematician.
- Simons Foundation: Collaboration Grants for Mathematicians, PI, 2020–2025 (\$42,000)

- Collective Behavior of Coupled Cells
- NSF-AWM Travel Grant for SIAM Dynamical Systems Conference, 2019 (\$2,300)

AWARDS & FELLOWSHIPS

- Flex Load Award, University of Iowa, Fall 2021
- Old Gold Summer Fellowship, University of Iowa, 2019
- Postdoc Travel Award, Dynamics Days, Denver, Colorado, 2018
- Student Travel Award, Conference on Decision and Control, 2014
- Research Assistantship, Rutgers University, 2014–2015
- University and Louis Bevier Dissertation Fellowship, Rutgers University, 2013–2014
- Student Travel Award, American Control Conference, 2013
- Weill Fellowship, Rutgers University, 2011
- Teaching/Research Assistantship, Rutgers University, 2009–2013

TEACHING

- University of Iowa
 - Introduction to Ordinary Differential Equations (Undergraduate), Fall 2024
 - Mathematical Biology I: Topics in Computational Neuroscience (Graduate), Fall 2024
 - Introduction to Mathematical Biology (Undergraduate), Spring 2024
 - Mathematical Biology I: Topics in Computational Neuroscience (Graduate), Fall 2023
 - Introduction to Mathematical Biology (Undergraduate), Spring 2023
 - Mathematical Biology II (Graduate), Spring 2023
 - Calculus I, Spring 2022 (Undergraduate, in-person)
 - Matrix Algebra, Spring 2021 (Undergraduate, online)
 - Mathematical Biology, co-instructor (C. Mitchell & Y. Wang), Fall 2020 (Graduate, in-person)
 - Nonlinear Dynamics with Numerical Methods, Fall 2020 (Graduate, in-person)
 - Topics in Mathematical Biology, Spring 2020 (Graduate)
 - Nonlinear Dynamics with Numerical Methods, Fall 2019 (Graduate)
 - Ordinary Differential Equations I, Fall 2019 (Graduate)
 - Matrix Algebra, Spring 2019 (Undergraduate)
 - Calculus II, Fall 2018 (Undergraduate)
- Princeton University
 - Topics in Mathematical Modeling - Mathematical Neuroscience, Fall 2017 (Undergraduate)
 - Applied Dynamical Systems, co-instructor (with C. Rowley), Fall 2016 (Graduate)
 - Nonlinear System Theory, Spring 2016 (Graduate)
- Rutgers University (Teaching Assistant for undergraduate courses)

- Calculus I for the Mathematical and Physical Sciences , Fall 2012
- Calculus II for the Mathematical and Physical Sciences, Fall 2011
- Calculus I for Biology, Spring 2011
- Calculus I for the Mathematical and Physical Sciences, Fall 2010
- Dynamical Models in Biology, Fall 2010

MENTORING

- University of Iowa
 - Graduate students
 - * Elizabeth Brass, Summer 2024
 - * Kerry Tarrant, Summer 2021–now
 - * Fatou Ndow, Fall 2020–now
 - * Parker Evans, Summer 2022 – Spring 2023
 - * Pake Melland, Spring 2020–Summer 2021 (co-mentoring with Prof. Curtu on a project)
 - * Ying Liu, Summer 2020
 - Postdocs
 - * Hamid Mofidi, Summer 2020
 - * Jeungeun Park, Summer 2019–Summer 2020
 - Undergraduate students
 - * Kaitlyn Stick-Mueller, 2023–2024
 - * Grace Peil, Summer 2023
 - * Ashley Sjurson, Spring 2021– Summer 2021
- Princeton University
 - Elizabeth Davison, Ph.D. student, Heterogeneity and Synchronization of Coupled Neuronal Oscillator Networks, Fall 2016–Spring 2018 (Technical Guidance with Prof. Naomi Ehrich Leonard)
 - Cathy Chen, undergraduate student, Decision Making in Networks of Heterogeneous Drift-Diffusion Processes, 2017–2018

SELECTED PRESENTATIONS

Invited Talk Presentations

- Mechanical Engineering Seminar, The University of New Mexico, April 2024
- Convergence with Control: Bridging the Arts, Ecology, Neuroscience, and Engineering, Princeton University, October 2023
- ACC 2023 workshop on Contraction Theory, San Diego, May 2023
- Colloquium, Department of Mathematics, University of California, Riverside, January 2023
- Colloquium, Department of Mathematics, University of Tennessee, Knoxville, December 2022
- SIAM Conference on Life Science, Pittsburgh, July 2022
- Mathematical Biology Seminar, Brandeis University, Virtual, March 2022

- Synchronization in Natural and Engineering Systems: A workshop hosted by UC Riverside & UC San Diego, Virtual, March 2022
- Mathematical Biology Seminar, University of Exeter, Virtual, February 2022
- Mathematical Biology Seminar, University of California Davis, Virtual, 2021
- Colloquium, Department of Mathematics, University of Denver, Virtual, January 2021
- CCDC Seminar at University of Californian Santa Barbara, Virtual, October 2020
- Dynamics Days Europe Conference, Virtual, August 2020
- SIAM Conference on Life Science, Virtual, June 2020
- SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, May 2019
- Dynamics Days Conference, Northwestern University, Evanston, IL, January 2019
- Seminar, Department of Mathematical Sciences, New Jersey Institute of Technology, April 2018
- Colloquium, Department of Mathematical & Statistical Sciences, U. of Alberta, January 2018
- Colloquium, Department of Mathematics, Brandeis University, January 2018
- Colloquium, Department of Mathematics and Statistics, Boston University, January 2018
- Colloquium, Department of Mathematics, Iowa State University, January 2018
- Colloquium, Department of Mathematics, University of Iowa, January 2018
- Colloquium, Department of Mathematics, Bucknell University, January 2018
- “Virtual” Network Frontier Workshop, December 2017
- Sensori-Motor Control of Animal and Robots, MBI, Ohio, November 2017
- Society for Mathematical Biology Annual Meeting, Utah, July 2017
- Department of Mathematics & Statistics, UMass Amherst, December 2016
- SIAM Life Science, Boston, July 2016
- Janelia Neurotheory Workshop, Janelia Research Campus, November 2015
- Conference of Decision and Control, Los Angeles, December 2014
- Dynamical Systems and Nonlinear Science Seminar, Princeton University, December 2014
- SIAM Life Science, North Carolina, August 2014
- Deterministic Modeling of Chemical Reactions, Interdisciplinary Boot Camp in Quantitative Biology, Guest Lecturer, January 2014
- American Control Conference, Washington, DC, June 2013

Poster Presentations

- SIAM Conference on Life Sciences, Portland, OR, June 2024 (Presented by K Tarrant - PhD student)
- SIAM Conference on Applications of Dynamical Systems, Portland, OR, May 2023 (Presented by F Ndow - PhD student)
- Dynamics Days 2018, Denver, Colorado, January 2018
- Workshop on Brain Dynamics and Neurocontrol Engineering, Washington University in St. Louis, St Louis, June 2017

- NSF-CRCNS Conference, Brown University, Providence, June 2017
- 6th annual Winter Workshop on Neuromechanics and Dynamics of Locomotion, Tulane University, New Orleans, January 2017

Presentations at University of Iowa

- U. Iowa Computational Psychiatry Symposium, April 2024
- U Iowa Biochemical Engineering graduate seminar, April 2024
- First year graduate students seminar, in-person, Spring 2022
- Undergraduate seminar, virtual, Spring 2021
- First year graduate students seminar, in-person, Fall 2020
- Undergraduate seminar, virtual, Spring 2020
- Mathematical Biology seminar (2 talks in Fall 2018 and 4 talks in Spring 2019)
- AMCS seminar, Spring 2019
- PDE seminar, Fall 2018
- First year graduate students seminar, Fall 2018

PROFESSIONAL ACTIVITY

- Member: SIAM, SMB, AWM
- Reviewer:
 - Journals: SIADS, Chaos, Biological Cybernetics, Journal of Nonlinear Sciences, Journal of Mathematical Biology, Automatica, IEEE Transactions on Automatic Control, IEEE Conference on Decision & Control, IEEE Transactions on Control of Network Systems, IEEE Transactions on Networks Science & Engineering, iScience, AMCS, Neurocomputing, Communications Biology
 - NSF panels
- Editor:
 - Guest Editor, Journal of Mathematics of Control, Signals, and Systems
 - Guest Editor, Open Journal of Control Systems

ORGANIZATIONAL ACTIVITY

- Chair of a session in American Control Conference, July 2024
- Organizer of Mathematical Biology Seminar, University of Iowa, 2013–2024
- Co-organizer of Mathematical Biology Seminar, University of Iowa, Fall 2022
- Co-organizer of a mini-symposium at SIAM Life Science, Pittsburgh, July 2022
- Co-organizer of a mini-symposium at SMB, June 2021
- Organizer of Mathematical Biology Seminar, University of Iowa, Spring 2021
- Co-organizer of a mini-symposium at SIAM Dynamical Systems, Snowbird, Utah, May 2019
- Member of the Scientific Advising Committee and Chair of Mathematical Biology Session in 7th Midwest WIMS, University of Iowa, Spring 2019

- Organizer of Mathematical Biology Seminar, University of Iowa, Spring 2019
- Co-chair of Math Colloquium, University of Iowa, 2018–2019

DEPARTMENTAL SERVICE

- Executive Committee, 2023–
- Search Committee for Analysis and PDE TT hiring (member), Fall 2023
- Course Development, Fall 2019:
 - Introduction to Mathematical Biology (Advanced Undergraduate Course)
 - Mathematical Biology I, II (Graduate Courses)
- Hiring Committee, Fall 2020
- Qualifying Exam Committee, Fall 2020 – Spring 2022
- Thesis Committee (member):
 - Joseph Sauder (Summer 2024), Ngoc Anh Phan (Spring 2024), Pake Melland (Spring 2021), Anh Nguyen (Fall 2019)
- Comprehensive Exam Committee (chair):
 - Kerry Tarrant (Summer 2023), Fatou Ndow (Summer 2022)
- Comprehensive Exam Committee (member):
 - Kitrick Fynaardt (Spring 2024), Nikita Kapur (Spring 2024), Joseph Small (Spring 2024), Samantha Warren (Fall 2022), Ying Liu (Fall 2022), Joseph Sauder (Spring 2022), Ngoc Anh Phan (Fall 2021), Daehan Choi (Fall 2020), Mitch Riley (Fall 2020), Rajinda Wickrama (Fall 2019)
- Academic advisor of four undergraduate students, since Fall 2019
- Mentor of a first-year graduate student, 2021-2022