ZAHRA AMINZARE

zahra-aminzare@uiowa.edu

http://www.math.uiowa.edu/~zaminzare

PROFESSIONAL AND ACADEMIC POSITIONS

- Associate Professor, Department of Mathematics, University of Iowa, since July 2024
- Assistant Professor, Department of Mathematics, University of Iowa, July 2018−June 2024
  - Faculty of The Interdisciplinary Graduate Program in Neuroscience, U. Iowa, Spring 2020–
  - Member of The Iowa Neuroscience Institute, U. Iowa, Fall 2019–
  - Faculty of AMCS, U. Iowa, Spring 2019–
- Postdoctoral Research Associate, PACM, Princeton University, May 2015–July 2018
  - Instructor, Department of Mathematics, Princeton University, Fall 2017
  - Instructor, Department of Mechanical and Aerospace Engineering, Princeton University, Spring 2016 and 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

MEMBERSHIPS

- Society for Industrial and Applied Mathematics, since 2019
- Association for Women in Mathematics, since 2020
- Society for Mathematical Biology, since 2020

PUBLICATIONS

Articles under review/revision

22. **Z. Aminzare** and J. E. Rubin. Rhythm Generation, Robustness, and Control in Stick Insect Locomotion. *https://doi.org/10.48550/arXiv.2504.11494*, 2025. Under review.
21. P. Melland, R. Curtu, and **Z. Aminzare**. Spike-adding mechanisms in a three-timescale fast-slow system: insights from the FitzHugh-Nagumo model with periodic forcing.
    https://doi.org/10.48550/arXiv.2411.00152, 2024. Under revision.
20. A. Nazerian, F. Sorrentino, and **Z. Aminzare**. Bridging the Gap between Reactivity, Contraction and Finite-Time Lyapunov Exponents. *https://doi.org/10.48550/arXiv.2410.23435*, 2024. Under revision.

Articles in journals

19. A. Kay and **Z. Aminzare**. Macromolecular condensation is unlikely to buffer intracellular osmolality. *https://doi.org/10.1101/2024.05.24.592450*, 2025.

18. **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.

17. **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.

16. **Z. Aminzare.** Stochastic logarithmic Lipschitz constants: A tool to analyze contractivity of stochastic differential equations. IEEE Control Systems Letters, vol. 6, 2311–2316, 2022.

15. J. Park and **Z. Aminzare.** A mathematical description of bacterial chemotaxis in response to two stimuli. Bull Math Biol, 84(9), 2021. (35 pages).

14. **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.

13. 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.

12. **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.

11. **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.

10. 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.

9. **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.

8. **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.

7. **Z. Aminzare** and E. Sontag. Logarithmic Lipschitz norms and diffusion-induced instability. Nonlinear Analysis: Theory, Methods and Applications, 83:31–49, 2013.

Book chapters

6. 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.

5. **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

4. **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.

3. **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.

2. **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.

1. 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.

Technical reports

Certain parts of these reports were published, while the remaining sections require expansion before being included in a new publication.

- F. Ndow and **Z. Aminzare**. Global synchronization analysis of non-diffusively coupled networks through Contraction Theory, arXiv:2307.00030, 2023.
- **Z. Aminzare** and V. Srivastava. Phase reduction and synchronization of coupled noisy oscillators, arXiv:3638491, 2021.
- **Z. Aminzare** and E. D. Sontag. Remarks on a population-level model of chemotaxis: advection-diffusion approximation and simulations, arXiv:1302.2605, 2013.

GRANTS

- Simons Foundation: Travel Support for Mathematicians, PI, MPS–TSM–00008005, 2024–2029 ($42,000)
- NSF standard grant IOS-2037828, 2021–2024 ($750,000)
  - Measuring and Mathematically Modeling Ionic Transport in Auditory Systems
  - Investigators: Kay (PI, biology), Aminzare (co-PI, lead Mathematician), Eberl (co-PI, biology)
- Simons Foundation: Collaboration Grants for Mathematicians, PI, 2020–2025 ($42,000)
- NSF-AWM Travel Grant for SIAM Dynamical Systems Conference, 2019 ($2,300)

HONORS AND AWARDS

- 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 (5 graduate and 5 undergraduate courses over 7 years)
  - Introduction to Mathematical Biology (Undergraduate), Spring 2025
  - 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

PROFESSIONAL MENTORING

- University of Iowa
  - Graduate students
    * Elizabeth Brass, Summer 2024–now
    * Kerry Tarrant, Summer 2021–now (supervising PhD thesis)
    * Fatou Ndow, Fall 2020–Fall 2024 (supervising PhD thesis)
    * 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
    - Hwanhee Byun, Spring 2025
    - Kaitlyn Stick-Mueller, 2023–2024
    - Grace Peil, Summer 2023
    - Ashley Kim Sjurson, Spring 2021– Summer 2021
- Princeton University
  - Elizabeth Davison, Ph.D. student, Heterogeneity and Synchronization of Coupled Neuronal Oscillator Networks, Fall 16–Spring 18 (Technical Guidance with Prof. Naomi Ehrich Leonard)
  - Cathy Chen, undergraduate student, Decision Making in Networks of Heterogeneous Drift-Diffusion Processes, 2017–2018

SELECTED PRESENTATIONS

Talk Presentations

upcoming SIAM Conference on Applications of Dynamical Systems, Denver, Colorado, May 2025

- Colloquium, Department of Mathematics, Creighton University, April 2025
- Workshop, Emergent Behavior in Complex Systems of Interacting Agents, IMSI, Chicago, March 2025
- Virtual Seminar, School of Natural Sciences, Institute for Advanced Study, December 2024
- 9th SIAM Annual Meeting of Central States Section, University of Missouri-Kansas City, October 2024
- 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

upcoming International Conference on Mathematical Neuroscience (ICMNS), Barcelona, Spain, June 2025

- 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

Graduate Students Presentations

- SIAM Conference on the Life Science, 2024, Portland, OR Poster Presentation by Kerry Tarrant
- SIAM Conference on Applications of Dynamical Systems, 2023, Portland, OR Poster presentation by Fatou Ndow
- SIAM Conference on Computational Science and Engineering, 2023, Amsterdam, Netherlands Talk presentation by Fatou Ndow
- African Women in Mathematics Webinars 2022- Virtual Talk presentation by Fatou Ndow

SERVICE

Community

- Reviewer:
  - Journals: SIAM Journal on Applied Dynamical Systems, SIAM Journal on Control and Optimization, 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
  - Multiple NSF panels & ISF, Simons Foundation
- Editor:
  - Guest Editor, Journal of Mathematics of Control, Signals, and Systems
  - Guest Editor, Open Journal of Control Systems
- Co-organizer (with Jonathan Rubin) of a mini-symposium at SIAM Dynamical Systems, Denver, Colorado, May 2025
- Chair of a session in American Control Conference, July 2024
- External member of comprehensive exam committee of Amirhossein Nazerian, Mechanical Engineering Department University of New Mexico, May 2024
- Co-organizer (with Jeungeun Park) of a mini-symposium at SIAM Life Science, Pittsburgh, July 2022
- Co-organizer (with Vaibhav Srivastava) of a mini-symposium at SMB, June 2021
- Co-organizer (with Elizabeth Davison) of a mini-symposium at SIAM Dynamical Systems, Snowbird, Utah, May 2019

Department - by calendar year

- **2025**
  - Executive Committee (Spring 2025)

- Search Committee: MathBio hiring (Spring 2025)
- Hiring Committee (Spring 2025)
- Thesis Committee (member): Casey Stone (Spring 2025)
- Comprehensive Exam Committee (member): Ian Ramsey (Spring 2025)
- First-Year Graduate Student Mentoring: Soumika Saha (Spring 2025)
- Academic advisor of four undergraduate students

- **2024**
  - Organizer of Mathematical Biology Seminar (Spring & Fall 2024)
  - Executive Committee (Spring & Fall 2024)
  - Search Committee: Analysis and PDE TT hiring (Fall 2024)
  - Thesis Committee (chair): Fatou Ndow (Fall 2024)
  - Thesis Committee (member): Joseph Sauder (Summer 2024), Ngoc Anh Phan (Spring 2024)
  - Comprehensive Exam Committee (member): Garrett Mason (Fall 2024), Kitrick Fynaardt (Spring 2024), Nikita Kapur (Spring 2024), Joseph Small (Spring 2024)
  - First-Year Graduate Student Mentoring: Cole Hengel (Spring 2024), Soumika Saha (Fall 2024)
  - Academic advisor of four undergraduate students
- **2023**
  - Organizer of Mathematical Biology Seminar (Spring & Fall 2023)
  - Executive Committee (Fall 2023)
  - Search Committee (Fall 2023)
  - Qualifying Exam Committee (Fall 2023)
  - Comprehensive Exam Committee (chair): Kerry Tarrant (Summer 2023)
  - First-Year Graduate Student Mentoring: Cole Hengel (Fall 2023)
  - Academic advisor of four undergraduate students
- **2022**
  - Qualifying Exam Committee (Spring 2022)
  - Comprehensive Exam Committee (chair): Fatou Ndow (Summer 2022)
  - Comprehensive Exam Committee (member): Samantha Warren (Fall 2022), Ying Liu (Fall 2022), Joseph Sauder (Spring 2022)
  - First-Year Graduate Student Mentoring: Juan Felipe Ariza Mejia (Spring 2022)
  - Academic advisor of four undergraduate students
- **2021**
  - Organizer of Mathematical Biology Seminar (Spring 2021)
  - Qualifying Exam Committee (Spring & Fall 2021)
  - Thesis Committee (member): Pake Melland (Spring 2021)

  - Comprehensive Exam Committee (member): Ngoc Anh Phan (Fall 2021)
  - First-Year Graduate Student Mentoring: Juan Felipe Ariza Mejia (Fall 2021)
  - Academic advisor of four undergraduate students
- **2020**
  - Qualifying Exam Committee (Fall 2020)
  - Hiring Committee (Fall 2020)
  - Comprehensive Exam Committee (member): Daehan Choi (Fall 2020), Mitch Riley (Fall 2020)
  - Academic advisor of four undergraduate students
- **2019**
  - Organizer of Mathematical Biology Seminar (Spring 2019)
  - Thesis Committee (member): Anh Nguyen (Fall 2019)
  - Comprehensive Exam Committee (member): Rajinda Wickrama (Fall 2019)
  - Course Development (Fall 2019)
    * Introduction to Mathematical Biology (Advanced Undergraduate Course)
    * Mathematical Biology I, II (Graduate Courses)
  - Member of the Scientific Advising Committee and Chair of Mathematical Biology Session in 7th Midwest WIMS, University of Iowa (Spring 2019)
  - Co-chair of Math Colloquium (Spring 2019)
  - Academic advisor of four undergraduate students
- **2018**: Co-chair of Math Colloquium (Fall 2018)

Outreach

- Organizing Math club for Wickham elementary school, Fall 2022–Spring 2024
- Co-organizing Math Competition for elementary/middle schools, Spring 2023