ZAHRA AMINZARE

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EMPLOYMENT

- Assistant Professor, Department of Mathematics, University of Iowa, since Fall 2018
- 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

Submitted

1. F. Ndow and **Z. Aminzare**. Global synchronization analysis of non-diffusively coupled networks through Contraction Theory.
2. **Z. Aminzare** and A. Kay. Mathematical modeling of ion homeostasis & cell volume stabilization: impact of ion transporters, impermeant molecules, & Donnan effect.

Articles in journals

3. **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.
4. **Z. Aminzare.** Stochastic logarithmic Lipschitz constants: A tool to analyze contractivity of stochastic differential equations. IEEE Control Systems Letters, vol. 6, 2311–2316, 2022.
5. J. Park and **Z. Aminzare.** A mathematical description of bacterial chemotaxis in response to two stimuli. Bull Math Biol, 84(9), 2021. (35 pages).
6. **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.
7. 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.
8. **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.

9. **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.

11. **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.

12. **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.

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

Book chapters

14. 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.

15. **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

16. **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.

17. **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.

18. **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.

19. 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

20. **Z. Aminzare** and V. Srivastava. Phase reduction and synchronization of coupled noisy oscillators, arXiv:3638491.

21. **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.

Papers in progress

22. Spike adding mechanism in FitzHugh-Nagumo model with periodic forcing (with Melland & Curtu).

GRANTS

- 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

Spring 2024: Introduction to Mathematical Biology (Undergraduate)

Fall 2023: Mathematical Biology (Graduate)

  - Mathematical Biology (Graduate) & Introduction to Mathematical Biology (Undergraduate), 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, Undergraduate)
  - 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
    - 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
    - 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

- 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 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

- 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, 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 panel
- Editor:
  - Guest Editor, Journal of Mathematics of Control, Signals, and Systems
  - Guest Editor, Open Journal of Control Systems

ORGANIZATIONAL ACTIVITY

- 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

- 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:
  - Pake Melland (Spring 2021), Anh Nguyen (Fall 2019)
- Comprehensive Exam Committee:
  - 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