FARSHAD SHIRANI

Curriculum Vitæ

Department of Physics	Email:	f.shirani@gatech.edu
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EMPLOYMENT & PROFESSIONAL EXPERIENCE

- **Associate Research Scientist** (2024–Present)
  Department of Physics, *Emory University*, Atlanta, USA
- **Visiting Assistant Professor** (2021–2024)
  School of Mathematics, *Georgia Institute of Technology*, Atlanta, USA
- **Postdoctoral Research Fellow** (2020–2021)
  Department of Neurology, McGovern Medical School, *University of Texas Health Science Center at Houston*, Houston, USA
- **Postdoctoral Fellow** (2018–2020)
  Department of Mathematics and Statistics, *Georgetown University*, Washington DC, USA
  Research advisor: Professor Judith R. Miller
- **Visiting Scholar** (2018–2019)
  Courant Institute of Mathematical Sciences, *New York University*, New York, USA
- **Graduate Research Assistant** (2013–2018)
  School of Aerospace Engineering, *Georgia Institute of Technology*, Atlanta, USA
- **Research Engineer and Project Coordinator** (2011–2012)
  Institute for Research in Robotics, Artificial Intelligence, and Information Sciences, *University of Tehran*, Tehran, Iran
- **Automation and Instrumentation Engineer and Project Coordinator** (2010–2011)
  FGME Company, Tehran, Iran
- **Instructor and Lab Manager** (2008–2011)
  Control and Intelligent Processing Center of Excellence, School of Electrical and Computer Engineering, *University of Tehran*, Tehran, Iran
- **Research Engineer** (2007–2008)
  Industrial Electronics Lab, School of Electrical and Computer Engineering, *University of Tehran*, Tehran, Iran

RESEARCH INTERESTS

- Mathematical biology: evolutionary ecology, population genetics, developmental biology
- Computational neuroscience: brain structure and function, neuronal circuit development
- Finite- and infinite-dimensional dynamical systems theory
- Partial differential equations
- Control systems theory and engineering
- Topological and statistical data analysis
- Bio-inspired robotics

EDUCATION

Georgia Institute of Technology (Atlanta, GA, USA)

- **PhD in Aerospace Engineering/Applied Mathematics (2018)**, GPA: 4.0/4.0
  Research advisor: Professor Rafael de la Llave
  Thesis: *Mathematical analysis of a mean field model of electroencephalographic activity in the neocortex*
- **MS in Mathematics (2017)**, GPA: 4.0/4.0
- **MS in Aerospace Engineering (2016)**, GPA: 4.0/4.0

University of Tehran (Tehran, Iran)

- **MS in Electrical Engineering (2007)**
  Research advisor: Prof. Babak Nadjar Araabi and Prof. Mohammad Javad Yazdanpanah
  Thesis: *Fuzzy-model-based controller design and stability analysis of nonlinear dynamical systems*
- **BS in Electrical Engineering (2005)**

Graduate Courses Taken

- **Mathematics:** Real Analysis I, Real Analysis II, Hilbert Spaces, Functional Analysis, Harmonic Analysis (audited), Operator Theory (audited), Partial Differential Equations I, Partial Differential Equations II, Ordinary Differential Equations I, Ordinary Differential Equations II (audited), Differentiable Dynamical Systems (audited), Numerical Methods in PDEs, Numerical Methods in Dynamical Systems, Differential Topology, Differential Geometry I, Probability I (audited), Statistical Estimation, High-Dimensional Statistics (audited), Stochastic Calculus (audited)
- **Engineering and Computational Science:** Quantitative Neuroscience, Bioinspired Computing, Random Processes, Regression Analysis, System Identification, Pattern Recognition, Digital Signal Processing, Advanced Dynamics I, Structural Dynamics, Power Electronics, Fuzzy Logic
- **Control Theory:** Linear Systems, Multivariable Linear Control, Nonlinear Control, Advanced Nonlinear Control, Optimal Guidance and Control, Robust Control, Adaptive Control

HONORS & AWARDS

- University of Tehran, College of Engineering Alumni Award for placing *first* in the national entrance exam for a graduate program, 2005.
- Recognized as a student of exceptional talent by the Iranian National Organization for Educational Testing, 2005.
- Member of the winning team of the School of Electrical and Computer Engineering's robotics competition, University of Tehran, 2004.

PUBLICATIONS

9. **F. Shirani** and B. G. Freeman, *Environmental "wiggles" as stabilizers of species range limits set by interspecific competition*, under review, (2024), pp. 1–34, doi:10.1101/2024.07.24.605034.
8. **F. Shirani** and J. R. Miller, *Matching habitat choice and the evolution of a species' range*, under review, (2024), pp. 1–56, doi:10.1101/2024.06.25.600700.

7. **F. Shirani** and H. Choi, *On the physiological and structural contributors to the overall balance of excitation and inhibition in local cortical networks*, Journal of Computational Neuroscience, 52 (2024), pp. 73–107, doi:10.1007/s10827-023-00863-x.

6. **F. Shirani** and J. R. Miller, *Competition, trait variance dynamics, and the evolution of a species' range*, Bulletin of Mathematical Biology, 84 (2022), 37, pp. 1–52, doi:10.1007/s11538-022-00990-z.

5. **F. Shirani**, *Transient neocortical gamma oscillations induced by neuronal response modulation*, Journal of Computational Neuroscience, 48 (2020), pp. 103–122, doi:10.1007/s10827-019-00738-0.

4. **F. Shirani**, W. M. Haddad, and R. de la Llave, *On the global dynamics of an electroencephalographic mean field model of the neocortex*, SIAM Journal on Applied Dynamical Systems, 16 (2017), pp. 1969–2029, doi:10.1137/16M1098577.

3. **F. Shirani**, M. J. Yazdanpanah, and B. N. Araabi, *Comments on "controller synthesis of fuzzy-dynamic systems based on piecewise Lyapunov functions"*, IEEE Transactions on Fuzzy Systems, 18 (2010), pp. 227–228, doi:10.1109/TFUZZ.2009.2036006.

2. **F. Shirani**, B. N. Araabi, and M. J. Yazdanpanah, *Fuzzy modelling of nonlinear systems for stability analysis based on piecewise quadratic Lyapunov functions*, in IEEE International Conference on Fuzzy Systems (IEEE World Congress on Computational Intelligence), June 2008, pp. 2230–2235, doi:10.1109/FUZZY.2008.4630679.

1. **F. Shirani**, M. J. Yazdanpanah, and B. N. Araabi, *Fuzzy-model-based exponentially stabilizing perturbed nonlinear systems in the presence of modeling error*, in IEEE International Conference on Systems, Man and Cybernetics, Oct 2007, pp. 3901–3906, doi:10.1109/ICSMC.2007.4414004.

ENGINEERING PROJECTS

3. *Design and Construction of an Intelligent Magnetic-Flux-Leakage Pipeline Inspection Gauge for 60-inch Natural Gas Pipelines*, University of Tehran and Segal Tech Engineering Company, Iran, 2011–2012.
   Sponsor: National Iranian Gas Company (about $1.2M)
   Role: Principal contributor and project coordinator of the data analysis section

2. *Functional Description and Cause & Effect Diagrams for the Direct Reduction Plant of Mobarakeh Steel Complex*, FGME Instrumentation and Engineering Company, Iran, 2010–2011.
   Sponsor: Iran International Engineering Company (about $100K)
   Role: Principal contributor and project coordinator

1. *Reverse Engineering a Digital Signal Processing (DSP) Starter Kit*, Industrial Electronics Lab, University of Tehran, Iran, 2007–2008.
   Role: Sole contributor

TEACHING (As Instructor of Record)

Georgia Institute of Technology (School of Mathematics)

- **MATH 3670: Probability and Statistics with Applications**
  Spring 2024, Spring 2023
- **MATH 1554: Linear Algebra**
  Fall 2023, Fall 2022, Spring 2022, Fall 2021

Georgetown University (Department of Mathematics and Statistics)

- **MATH 035: Calculus I**
  Fall 2019

University of Tehran (School of Electrical and Computer Engineering)

- **ECE 174: Linear Algebra**
  Spring 2011, Spring 2010, Fall 2009
- **ECE 012: Linear Control Systems Lab**
  Spring 2009, Fall 2008, Fall 2005, Summer 2005, Spring 2005

TEACHING ASSISTANCE

University of California, San Diego (Department of Mechanical & Aerospace Engineering)

- **MAE 140: Linear Circuits**
  Winter 2013, Fall 2012

University of Tehran (School of Electrical and Computer Engineering)

- **ECE 640: Advanced Nonlinear Control**
  Spring 2009
- **ECE 237: Nonlinear Control**
  Spring 2009, Spring 2008
- **ECE 312: Digital Control Systems**
  Spring 2006
- **ECE 224: Linear Control Systems**
  Fall 2006, Spring 2006, Fall 2005

SCIENTIFIC SOCIETY MEMBERSHIP

- Society for Mathematical Biology (SMB)
- Society for Industrial and Applied Mathematics (SIAM)
- American Society of Naturalists (ASN)
- American Physical Society (APS)