M.J. Mirshojaeian Hosseini

Mechatronics Engineer · PhD in *Soft Robotics*

(+1) 317-332-8220 | mjmir@stanford.edu | mjmir | M.J. Mirshojaeian Hosseini

Summary

With over 7 years of experience, I specialize in designing, fabricating, and characterizing flexible nanostructures and organic neuromorphic circuits. My expertise extends to working hands-on in Iso 4 cleanrooms and fabrication labs, utilizing a range of techniques such as e-beam and thermal PVD, ALD, Sputtering, photolithography, CVD, profilometry, and wet chemical processing methods.

My areas of expertise include neuromorphic systems, nanofabrication, biosensors, lab-on-a-chip technologies, printing electronics, organic nanoelectronics, artificial intelligence, 3D printers, microfluidics, control engineering, fault detection and identification, solid and fluid mechanics, and design.

Education

Purdue University
West Lafayette, IN, USA

Ph.D. in Soft Robotics (Neuromorphic computation) — *8/10/2018 - 8/4/2023*

- **Thesis:** An organic neural circuit: Towards flexible and biocompatible organic neuromorphic processing
- **Advisor:** Robert A. Nawrocki

K. N. Toosi University of Technology
Tehran, Iran

M.Sc. in Mechatronic Engineering — *9/23/2010 - 9/22/2013*

- **Thesis:** Design, Simulation and Control of an electro-hydrostatic actuator using an adaptive neuro-fuzzy PID controller
- **Advisor:** Mahdi A. Shoorehdeli

Ferdowsi University of Mashhad
Mashhad, Iran

B.Sc. in Mechanical Engineering — *9/23/2005 - 9/22/2010*

- **Thesis:** Analysis and examination of governing equations of DC and AC Motors
- **Advisor:** Alireza A. Tootoonchi

Work Experience

Stanford University
Stanford, CA, USA

Postdoctoral Researcher - Adviser: Zhenan Bao — *1/13/2025 - Present*

- Collaborate on the development of a stretchable monolithic organic CMOS platform that achieves MHz-range ring oscillator frequencies, addressing speed limitations in current stretchable electronics.
- Design and fabricate a stretchable neuromorphic multiplexer leveraging monolithic CMOS technology to encode a 3×3 pressure sensor array, optimized for decoding through biologically inspired leaky integrate-and-fire neural circuits.
- Develop a stretchable analog neural network with a single input and dual outputs, aimed at real-time decoding of compressed sensory signals from the neuromorphic multiplexer to demonstrate distributed and low-power signal processing in soft electronics.

Purdue University
West Lafayette, IN, USA

Postdoctoral Researcher - Adviser: Robert A. Nawrocki — *9/11/2023 - 9/2/2024*

- Developed a flexible neuromorphic processor using organic materials with four inputs and two outputs to control a four-wheel mobile robot.
- Designed and implemented a manual shadow mask aligner with $5\mu m$ resolution for shadow masking organic thin films.
- Developed ultra-low voltage p-type OFETs resistant to ambient conditions over one year.
- Mentored two PhD students.

Purdue University
West Lafayette, IN, USA

Graduate Research Assistant - Adviser: Robert A. Nawrocki — *8/10/2018 - 8/4/2023*

- Developed the thinnest reported (270 nm) e-skin medical device recorder to collect and amplify ECG and EMG signals with a gain exceeding 1k.
- Fabricated the first flexible solid-state neuron using organic materials, mimicking key functions of a biological neuron, including learning.
- Developed a modeling approach for analog organic circuits, enabling the simulation of complex behavior in circuits such as organic neuromorphic circuits.
- Introduced an organic electronics implementation of an Integrate-and-Fire spiking somatic circuit based on the Axon-Hillock CMOS circuit.
- Demonstration of an organic differential-pair integrator (DPI) synaptic circuit implemented using physically flexible complementary organic electronics.
- Presented a physically flexible organic log-domain integrator (LDI) synaptic circuit that utilizes electrically active organic-based materials with biocompatibility and biologically plausible time constants.
- Over five years of experience as a Lab Operations Manager overseeing advanced nanofabrication equipment, spearheading training initiatives, and fostering interdisciplinary collaborations.
- Coached three BS students.

Mashhad University of Medical Science *Mashhad, Iran*

Research Associate - Adviser: Seyed Ali Mousavi Shaegh *9/8/2017 - 8/5/2018*

- Led a cross-disciplinary project to implement an additive manufacturing technology for cell 3D printing.
- Played a key role in developing whole-thermoplastic microfluidic microvalves and micropumps for lab-on-chip applications.
- Conducted research on prosthetic robotic hands and fingers.

Ferdowsi University of Mashhad *Mashhad, Iran*

Research Associate - Adviser: Seyed Kamal Hosseini Sani *9/23/2015 - 8/1/2017*

- Developed a 3D-printed autonomous underwater vehicle featuring dual tilt-rotors, involving concept design, detailed design, prototype fabrication, fluid and solid finite element analysis, power and control electronics integration, and Python coding.
- Implemented model predictive control (MPC) algorithm to control the 3D-printed autonomous underwater vehicle.
- Fabricated an $80\,\mathrm{cm} \times 100\,\mathrm{cm} \times 50\,\mathrm{cm}$ FDM 3d printer to print the AUV body.

Skills

Engineering (Software)	Labview, Matlab, Simulink, Solidworks, COMSOL, NX, Abaqus, Simplify, S7 Lite (PLC programming), JMP
Discipline	Process engineering, Real-time data acquisition, Material science Electronics, Solid and fluid mechanics design, 3D printing, Control engineering, Mechatronics
Hands-on skills	Manual and automated assembly systems, Testing and troubleshooting, Mechanical aptitude, Automation
Physics	Nanofabrication, Cleanroom, photolithography, Wet chemical processing, Thin-film devices
Programming	Python, FORTRAN, C
Software	Adobe Illustrator, Microsoft Access, Microsoft Office.

Certifications

Stanford Ignite, Stanford University Graduate School of Business *USA*

Microsoft Certified Systems Administrator (MCSA), Microsoft *USA*

Microsoft Certified Systems Engineer (MCSE), Microsoft *USA*

Selected Publications

- **Mirshojaein Hosseini, M. J.**, Yang, Y., Kruger, W., Yokota, T., Lee, S., Someya, T., and Nawrocki, R. A. 270 nm, ultra-thin, self-adhesive, conformable, and long-term air-stable organic electronics biosignal amplifying circuits. *NPJ Flexible Electronics*, vol. 7, no. 1, pp. 1–12, Aug. 2023, doi: `https://doi.org/10.1038/s41528-023-00267-y`
- Yang, Y., **Mirshojaein Hosseini, M. J.**, Kruger, W., and Nawrocki, R. A. Modular modeling of analog organic neuromorphic circuits: Toward prototyping of hardware-level spiking neural networks. *IEEE Transactions on Circuits and Systems I: Regular Papers 70*, 3 (2023), 1161–1174 `https://ieeexplore.ieee.org/abstract/document/9976306`
- **Mirshojaeian Hosseini, M. J.**, Yang, Y., Prendergast, A. J., Donati, E., Faezipour, M., Indiveri, G., and Nawrocki, R. A. An organic synaptic circuit: towards flexible and biocompatible organic neuromorphic processing. *Neuromorphic Computing and Engineering 2*, (2022) 034009 `https://iopscience.iop.org/article/10.1088/2634-4386/ac830c`
- **Mirshojaein Hosseini, M. J.**, Donati, E., Indiveri, G., and Nawrocki, R. A. Organic log-domain integrator synapse. *Advanced Electronic Materials 8*, 2 (2021), 2100724 `https://onlinelibrary.wiley.com/doi/abs/10.1002/aelm.202100724`
- **Mirshojaein Hosseini, M. J.**, and Nawrocki, R. A. A review of the progress of thin-film transistors and their technologies for flexible electronics. *Micromachines 12*, 6 (2021), 655 `https://www.mdpi.com/2072-666X/12/6/655`
- **Mirshojaein Hosseini, M. J.**, Donati, E., Yokota, T., Lee, S., Indiveri, G., Someya, T., and Nawrocki, R. A. Organic electronics axon-hillock neuromorphic circuit: towards biologically compatible, and physically flexible, integrate-and-fire spiking neural networks. *Journal of Physics D: Applied Physics 54*, 10 (2020), 104004 `https://iopscience.iop.org/article/10.1088/1361-6463/abc585/meta`
- Banejad, A., Passandideh-Fard, M., Niknam, H., **Mirshojaeian Hosseini, M. J.**, and Mousavi Shaegh, S. A. Design, fabrication and experimental characterization of whole-thermoplastic microvalves and micropumps having micromilled liquid channels of rectangular and half-elliptical cross-sections. Sensors and Actuators A: Physical 301 (2020), 111713 `https://www.sciencedirect.com/science/article/abs/pii/S0924424719316589`

Selected Presentations

- **Mirshojaeian Hosseini, M. J.**; Yang, Y.; Prendergast, A. J.; Donati, E.; Faezipour, M.; Indiveri, G.; Nawrocki, R. A., Soft Spiking synaptic Circuits for Neural Interfaces, *MRS Spring 2022 Meeting*
- **Mirshojaeian Hosseini, M. J.**; Yang, Y.; Donati, E.; Indiveri, G.; Nawrocki, R. A., Spiking Organic Electronics Synaptic Circuits, *MRS Fall 2021 Meeting*
- **Mirshojaeian Hosseini, M. J.**; Donati, E.; Indiveri, G.; Nawrocki, R. A., Organic Electronics Axon-Hillock Neuromorphic Circuit: Towards Biologically Compatible, And Physically Flexible, Integrate-And-Fire Spiking Neural Networks, *MRS Fall 2020 Meeting*

Research Grant

2019-2021 **Purdue Research Foundation**, $29,976.00 *USA*

Patents

2025 **Ultra-low voltage, flexible, and biocompatible complementary organic transistors with single-substrate integrated capacitors.**, USPTO *USA*

2025 **Solid-state organic, biocompatible, flexible neuron**, USPTO *USA*

2011 **DC motor parameter analyzer**, Organization for the Registration of Deeds and Property *Iran*

Supervised Students

Purdue University *West Lafayette, IN, USA*

Summer Undergraduate Research Fellowship (SURF) program

- **2021 - 2022** Walter Kruger; BS in EET from SoET, Purdue University.
- **Summer of 2019** Dakota Jake Warren; BS in AET from SoET, Purdue University.
- **2018–2019** Shih Hsuan (Vick) Hung; BS in EET from SoET, Purdue University.

Teaching Experience

Ferdowsi University of Mashhad *Mashhad, Iran*

Teacher Assistant *2017*

- Model Predictive Control

Ferdowsi University of Mashhad *Mashhad, Iran*

Teacher Assistant *2015*

- Adaptive Control

Khorasan Institute of Higher Education *Mashhad, Iran*

Instructor *2014*

- Actuation Systems

K. N. Toosi University of Technology *Tehran, Iran*

Teacher Assistant *2011*

- Industrial Control

Honors & Awards

2024 **Employee Recognition Award**, for the efficiency improvement. *West Lafayette, USA*

2017 **3rd Place**, for the novel design of a tilt-rotor AUV at "Iran Darya" The 3rd Maritime National Festival. *Tehran, Iran*

2013 **Ranked 1st**, based on GPA among 21 M.Sc. mechatronic students of K.N. Toosi University of Technology. *Tehran, Iran*