

## **Siamak Faal, Ph.D.**

### **status**

US Permanent Resident

### **Contact**

- siamak.faal@gmail.com
- Worcester, MA

### **profession**

Applied Scientist / Research Scientist in Robotics

### **summary**

Highly motivated applied scientist with demonstrated success in developing and implementing technologies and solutions in robotics, mechatronics, control, and optimization. Expert at design and implementation of novel algorithms to a variety of advanced robotic and mechatronic systems. Proficient in orchestrating teams to prototype, build, test, and maintain hardware and software solutions. Passionate about conducting comprehensive research in collaborative environments.

### **education**

- Ph.D. in Robotics Engineering, ‘institution’: ‘Worcester Polytechnic Institute, MA’, ‘year’: 2018
- Master of Science in Applied Mathematics’, ‘institution’: ‘Worcester Polytechnic Institute, MA’, ‘year’: 2019
- Master of Science in Mechatronics’, ‘institution’: ‘Sharif University of Technology, Iran’, ‘year’: 2012
- {‘degree’: ‘Bachelor of Science in Mechanical Engineering’, ‘institution’: ‘Sharif University of Technology, Iran’, ‘year’: 2009}

### **expertise**

- Optimization and Control
- AI, Machine Learning, and Deep Learning
- Robotic, Mechatronic, and Automation
- Image Processing and Computer Vision
- Motion and Trajectory Planning and Optimization
- PDE, ODE, and Numerical Analysis
- Simulation and Modeling
- Systems Engineering

## technical\_proficiency

- **programming:** C, C++, Python, MATLAB, JavaScript, GO, PHP, BASH
- **scientific\_computing:** MATLAB, SciPy, NumPy, CUDA, OpenCL
- **embedded\_systems:** RTOS, Embedded C, 'Embedded Python', 'Altium Designer', 'Proteus Design Suite'
- **robotics:** ['ROS', 'Simscape Multibody', 'MuJoCo', 'Gazebo']
- **ml\_dl\_cv:** ['MATLAB', 'OpenCV (Python & C++)', 'PyTorch', 'TensorFlow']
- **cad:** ['SolidWorks', 'AutoCAD', 'Creo']
- **markup\_language:** ['TeX', 'LaTeX', 'HTML', 'CSS']

## professional\_experience

- {'role': 'Applied Scientist', 'company': 'Kodama, CA', 'year': 2023, 'description': 'Designing and implementing motion planning algorithms for autonomous forestry machinery. Creating models, performing simulations and data analysis, and providing optimized solutions for various tasks and assignments involved in forestry.'}
- {'role': 'Robotic Applied Scientist', 'company': 'Amazon, WA', 'year': 2022, 'achievements': ['Reduced consolidation cycle time from 12.8 s to 1.8 s (~70% decrease in time; faster than 2 s original design criterion) by formulating, solving, and implementing an optimal control solution in less than 2 months of tenure.']}
- {'role': 'Computational Scientist', 'company': 'Worcester Polytechnic Institute, MA', 'period': '2019 – 2022', 'achievements': ['Developed a remote code editor and compiler with a full API support, embeddable in Canvas, to provide interactive examples for languages such as C++, HTML, LaTeX, Octave, and Python.', 'Initiated and supervised the development of asynchronous online software trainings and automated certifications.']}
- {'role': 'Adjunct Professor', 'company': 'Worcester Polytechnic Institute, MA', 'period': '2019 – 2022', 'achievements': ['Coordinated faculty to redesign course material, delivery methods and software applications used for the Calculus labs that led to a 72% increase in student engagement and mastery of the subject.', 'Customized course materials with engaging real-world examples to encourage project-based learning.']}
- {'role': 'Postdoctoral Researcher', 'company': 'Department of Mathematical Sciences, Worcester Polytechnic Institute, MA', 'year': 2019, 'achievements': ['Formulated a stable and robust Newton's iterations to solve the finite element problem for Cahn-Hilliard Equations with a logarithmic nonlinear potential function.', 'Developed MATLAB and C++ applications to solve the finite element problem with BPX preconditioning.']}

## academic\_research

- **description:** Developed and implemented optimal BPX preconditioner for Cahn-Hilliard equations with logarithmic potential function. Studied the effect of input saturation in nonlinear closed-loop systems. Formulated and experimentally validated a decentralized method to achieve collective object manipulation with swarm robotic systems. Formulated Jacobian based controllers for underactuated systems, particularly unmanned aerial vehicles.

## affiliations\_leadership

- {'role': 'President', 'organization': 'Lecture, A Multidisciplinary Learning & Teaching Organization, Worcester Polytechnic Institute, MA', 'period': '2015 – 2018'}
- {'role': 'Chair', 'organization': 'Iranian Students Association, Worcester Polytechnic Institute, Worcester, MA', 'period': '2016 – 2017'}
- {'role': 'Director', 'organization': 'Robotic Group, Sharif University of Technology, International campus, Kish, Iran', 'period': '2007 – 2012'}
- {'role': 'Director', 'organization': 'Mechatronic Workshop, Sharif University of Technology, International campus, Kish, Iran', 'year': 2009}

## academic\_community\_activities

- **peer\_reviews:** ['IEEE Conference – Automation Science & Engineering; International Symposium on Assembly & Manufacturing (CASE & ISAM)', 'IEEE Conference – Technologies for Practical Robot Applications (TePRA)', 'IEEE International Conference – Robotics and Automation (ICRA)', 'IEEE Transactions – Mechatronics', 'IEEE Transactions – Robotics', 'Springer Intelligent Service – Robotics']
- **educational\_outreach:** ['Engineering Software (Frontiers II), Frontiers Summer STEM Residential Camp, Worcester Polytechnic Institute, MA, 2017/2018', 'Mechanical Engineering (Frontiers I), Frontiers Summer STEM Residential Camp, Worcester Polytechnic Institute, MA, 2017']
- **professional\_development:** ['Individual Development Plan, Worcester Polytechnic Institute, MA, 2017', 'Research Communication Series, Worcester Polytechnic Institute, MA, 2017', 'Faculty Institute for Online Teaching, Worcester Polytechnic Institute, 2020', 'Project management Online Course, University of Adelaide, edX.org, 2016', 'Presenting Data & Information Course, Edward Tufte, Boston, MA, 2015']
- **awards\_honors:** ['Best Conference Paper Award (ABB), 12th IEEE International Conference on Automation Science & Engineering (CASE), 2016', 'Teaching Assistant of the Year Award, Worcester Polytechnic Institute, 2015', 'Ranked 2nd among all Mechatronics M.S. Students, Sharif University of Technology, Class of 2012', 'Ranked 2nd among all Mechatronics B.S. Students, Sharif University of Technology, Class of

2009’]

## publications

- {‘title’: ‘Robust BPX Solver for Cahn–Hilliard Equations’, ‘year’: 2022, ‘journal’: ‘Domain Decomposition Methods in Science and Engineering XXVI. Lecture Notes in Computational Science and Engineering, vol 145. Springer, Cham.’}
- {‘title’: ‘A Feedback-Planning Scheme to Synthesize Control Functions’, ‘year’: 2020, ‘conference’: ‘American Control Conference (ACC), 1743-1748.’}
- {‘title’: ‘A computationally efficient approach to decentralized routing of swarms via a family of pre-fractal curves’, ‘year’: 2019, ‘conference’: ‘American Control Conference (ACC), 1482-1487.’}
- {‘title’: ‘An optimized and automated approach to quantifying channelrhodopsin photocurrent kinetics’, ‘year’: 2019, ‘journal’: ‘Analytical Biochemistry, Volume 566, Pages 160-167.’}
- {‘title’: ‘A decentralized communication free force distribution method with application to collective object manipulation’, ‘year’: 2018, ‘journal’: ‘ASME Journal of dynamic systems, measurement, and control.’}
- {‘title’: ‘Decentralized obstacle avoidance in collective object manipulation’, ‘year’: 2017, ‘conference’: ‘NASA/ESA Conference on Adaptive Hardware and Systems (AHS 2017), California.’}
- {‘title’: ‘Scalable cooperative impedance control of an object via a decentralized force control approach for swarm systems’, ‘year’: 2017, ‘conference’: ‘American Control Conference (ACC), Seattle, Washington.’}
- {‘title’: ‘Regionally Growing Random Trees: a synergistic motion planning and control algorithm for dynamic systems’, ‘year’: 2016, ‘conference’: ‘International Conference on Automation Science and Engineering, (CASE), Fort Worth, Texas.’}
- {‘title’: ‘Design, fabrication, experimental analysis, and test flight of an origami-based fixed-wing aerial vehicle:  $\mu$ Plane’, ‘year’: 2016, ‘conference’: ‘ASME 40th Mechanisms and Robotics Conference, Charlotte, North Carolina.’}
- {‘title’: ‘Towards collective manipulation without inter-agent communication’, ‘year’: 2016, ‘conference’: ‘Intelligent Robotics and Multi-Agent Systems (IRMAS), Pisa, Italy.’}
- {‘title’: ‘Tribot: a minimally actuated accessible holonomic hexapedal platform’, ‘year’: 2015, ‘conference’: ‘IEEE/RSJ International Conference on Intelligent Robots and Systems, Hamburg, Germany.’}
- {‘title’: ‘Hierarchical kinematic design of foldable hexapedal locomotion platforms’, ‘year’: 2015, ‘journal’: ‘ASME Journal of Mechanisms and Robotics, JMR 3, no. 4L3.’}
- {‘title’: ‘Design and fabrication of a foldable hexapod robot towards experimental swarm applications’, ‘year’: 2014, ‘conference’: ‘International Conference on Robotics and Automation (ICRA).’}