Saeed Azad, Ph.D.

Postdoctoral Fellow, Systems Engineering Department, Colorado State University

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Academic Appointments

☐ **Postdoctoral Fellow**   *July 2021 - Present*
Systems Engineering Department   *Colorado State University, Fort Collins, CO*
Advisor: Dr. Daniel R. Herber 🌐

☐ **Lecturer**   *August 2020 - July 2021*
Physics, Geology, & Eng. Tech. Dep.   *Northern Kentucky University, Highland Heights, KY*
Supervisor: Dr. Sharmanthie Fernando 🌐

Education

☐ **Ph.D. in Mechanical Engineering**   *August 2016 - August 2020*
Mechanical & Materials Engineering Department   *University of Cincinnati, Cincinnati, OH*
Advisor: Dr. Michael J. Alexander-Ramos 🌐
Dissertation: Combined design and control optimization of stochastic dynamic systems 📄

☐ **Graduate Certificate in Preparing Future Faculty Program** 🌐   *May 2019- May 2020*
College of Arts and Sciences   *University of Cincinnati, Cincinnati, OH*

☐ **M.Sc. in Mechanical Engineering**   *August 2014 - May 2016*
Inamori School of Engineering   *Alfred University, Alfred, NY*
Advisor: Dr. Ehsan Ghotbi 🌐
Thesis: A game theoretic approach to retail electricity market with a high penetration of small and mid-size renewable suppliers 📄

☐ **B.Sc. in Mechanical Engineering**   *August 2006 - August 2010*
School of Engineering   *Islamic Azad University of Mashhad, Mashhad, Iran*

Research Interests

☐ **Methodology**: computational design, combined design and control optimization (control co-design or CCD), dynamic systems, machine learning, active learning, system-level design, uncertainty modeling, uncertainty quantification, uncertain control co-design, advanced control techniques, data-driven modeling, surrogate modeling, adaptive and learning control, design optimization, robust design and control, reliability-based design optimization, optimal control theory, multidisciplinary design optimization, stochastic dynamic systems, fuzzy systems, generalized polynomial chaos, robust model predictive control, system reliability, modeling and simulation, design for resilience, data-driven design, expected utility theory, game theory

☐ **Applications**: wave energy converter farm design, control, and layout, wave-to-wire modeling, energy systems, wind turbine design, marine hydrokinetic turbines, hybrid-electric vehicle and plug-in hybrid-electric vehicle powertrain design and control, automotive system design, mechanical systems, wireless power transfer for vehicle applications, connected and automated vehicles, aerospace systems, underwater vehicle design

Research Experience

☐ **Postdoctoral Fellow** *July 2021 - Present*
Herber Research Group 🌐 *Colorado State University, Fort Collins, CO*

- Conducted research on an NSF-funded and NREL-supported project on *probabilistic performance assessment and control co-design of wave farms*
- Developed models and workflows for concurrent plant, control, and layout optimization of wave energy converter farms with efficient estimation of hydrodynamic coefficients using many-body expansion
- Implemented machine learning techniques and active learning strategies for estimation of hydrodynamic coefficients in wave energy converter farms
- Conducted research on formulations and solution strategies for uncertain control co-design problems and implemented a robust multi-stage model predictive control co-design
- Developed a generalized polynomial chaos expansion for uncertainty quantification in system-level design and published the code as open-source
- Advised and mentored an undergraduate researcher on control co-design of a natural gas power plant with carbon capture and hot storage through the SURE program 🌐
- Led the efforts to submit a proposal focused on open-source uncertain control co-design toolbox to NSF's Community Infrastructure for Research in Computer and Information Science and Engineering (CIRC)

☐ **Test and Validation Intern** *May 2019 - August 2019*
Test and Validation Group 🌐 *P3 North America (currently umlaut, Southfield, MI)*

- Researched the potential of stationary and dynamic wireless power transfer for vehicle applications as a technical service area to provide to original equipment manufacturers
- Performed conformance and interoperability testing between electric vehicle and electric vehicle supply equipment in conductive charging
- Tested in-vehicle communication for infotainment systems in customer vehicles for various use cases
- Tested customer's ridesharing phone applications and platform to identify communication bugs and improvement areas

☐ **Research Assistant** *August 2016 - August 2018*
Integrated Vehicle Design Laboratory 🌐 *University of Cincinnati, Cincinnati, OH*

- Conducted dissertation research on various approaches towards formulating and solving uncertain control co-design problems
- Implemented uncertainty-driven control co-design formulations for a vehicle powertrain using robust control co-design
- Implemented a reliability-based control co-design formulation for a vehicle active suspension system
- Developed the first known uncertainty-driven formulation in control co-design using concepts from robust design optimization
- Calibrated and validated time-domain, mathematical models for a hybrid-electric and plug-in hybrid-electric vehicle powertrain and its major component
- Led and mentored undergraduate and graduate researchers in the Integrated Vehicle Design Laboratory

☐ **Student Researcher**   *August 2014 - August 2016*
Inamori School of Engineering ⏣   *Alfred University, Alfred, NY*

- Conducted thesis research on the application of game theory in electricity markets with small renewable suppliers
- Developed mathematical models associated with energy generation and retail electricity market dynamics
- Developed heating, ventilation, and air conditioning models and load estimations in Autodesk Revit for the Alfred team in the 2015 U.S. DOE Solar Decathlon

Invited Talks & Presentations

☐ S Azad, "Overview of uncertain control co-design," National Science Foundation workshop on Control Co-Design Research, Champaign, Illinois, May 2023. ⏣

Publications - Upcoming Articles

☐ S Azad, DR Herber, S Khanal, G Jia, "Integrated Design for Wave Energy Converter Farms: Assessing Plant, Control, Layout, and Site Selection coupling in the Presence of Irregular Waves," (submitted) *ASME International Design Engineering Technical Conference, Aug. 2024.*

☐ S Azad, Z Gulumjanli, DR Herber, "A General framework for supporting economic feasibility of generator and storage energy systems through capacity and dispatch optimization," (submitted) *ASME International Design Engineering Technical Conference, Aug. 2024.*

☐ S Azad, DR Herber, S Khanal, G Jia, "Site-dependent solutions of wave energy converter farms with surrogate models, control co-design, and layout optimization," (Accepted) *American Control Conference.*

☐ S Azad, DR Herber, G Jia, "A system-level approach for concurrent plant, control, and layout optimization of wave energy converter farms using machine learning," (to be submitted to) *Ocean Engineering.*

☐ S Azad and DR Herber, "On uncertain control co-design solution strategies with various control architectures," (to be submitted to) *Journal of Dynamic Systems, Measurement, and Control.*

Publications - Journal Articles

☐ S Azad and DR Herber, "An overview of uncertain control co-design formulations," *Journal of Mechanical Design*, vol. 145, no. 9, p.091709, 2023. 📄

☐ S Azad and MJ Alexander-Ramos, "Robust combined design and control optimization of hybrid-electric vehicles using MDSDO," *IEEE Transactions on Vehicular Technology*, vol. 70, no. 5, p. 4139-4152, 2021. 📄

☐ S Azad and MJ Alexander-Ramos, "A single-loop reliability-based MDSDO for combined design and control optimization of stochastic dynamic systems," *ASME Journal of Mechanical Design*, vol. 143, no. 2, p.021703, 2020. 📄

☐ S Azad and MJ Alexander-Ramos, "Robust MDSDO for co-design of stochastic dynamic systems," *ASME Journal of Mechanical Design*, vol. 142, no. 1, p.011403-1–8, 2020. 📄

☐ S Azad, M Behtash, A Houshmand, MJ Alexander-Ramos, "PHEV powertrain co-design with vehicle performance considerations using MDSDO," *Structural and Multidisciplinary optimization*, vol. 60, p. 1155-1169, 2019. 📄

☐ S Azad and E Ghotbi, "A game equilibrium model of a retail electricity market with high penetration of small and mid-size renewable suppliers," *The Electricity Journal*, vol. 30, no. 5, p. 22-29, 2017. 📄

Publications - Conference Proceedings

☐ S Azad and DR Herber, "Concurrent probabilistic control co-design and layout optimization of wave energy converter farms using surrogate modeling," in *ASME International Design Engineering Technical Conferences,* Aug. 2023. 📄

☐ S Azad and DR Herber, "Investigations into uncertain control co-design implementations for stochastic in expectation and worst-case robust," in *ASME International Mechanical Engineering Congress & Exposition,* Nov. 2022. 📄 🎥

☐ S Azad and DR Herber, "Control co-design under uncertainties: formulations," in *ASME International Design Engineering Technical Conferences,* Aug. 2022. 📄 🎥

☐ S Azad and MJ Alexander-Ramos, "Reliability-based MDSDO for co-design of stochastic dynamic systems," in *ASME International Mechanical Engineering Congress & Exposition,* Nov. 2019. 📄

☐ S Azad and MJ Alexander-Ramos, "Robust MDSDO for co-design of stochastic dynamic systems," in *ASME International Design Engineering Technical Conferences,* Aug. 2018. 📄

☐ S Azad, M Behtash, A Houshmand, MJ Alexander-Ramos, "Comprehensive PHEV powertrain co-design performance studies using MDSDO," in *World Congress of Structural and Multidisciplinary Optimization,* June 2017. 📄

☐ S Azad and E Ghotbi, "Nash equilibrium of a retail electricity market with a high penetration of small renewable suppliers," in *ASME Power Conference,* June 2016. 📄

Teaching Experience

☐ **Lecturer** *August 2020 - August 2021*
Phys. Geol. & Eng. Tech. 🌐 *Northern Kentucky University, Highland Heights, KY*

- *Statics and Strength of Materials*
  Description: Theory and applications of mechanics of rigid bodies in equilibrium; the mechanical behavior of members of engineering structures: stress, strain, torsion, shear, bending moments, beam deflection and combined loading
  Details: Offered online and asynchronous (due to COVID-19) to two sections in Fall 2020, each with approximately 17 students
- *Machine Design*
  Description: Principles of mechanical design, including structural analysis, materials selection, kinematics, and selection of individual machine part, such as shafts, bearings, gears, and screws
  Details: Taught in an online and asynchronous format (due to COVID-19) to one section each in Fall 2020 and Summer 2021, each with approximately 16 students
- *Engineering Materials*
  Description: Introduction into the nature and family of materials, synthesis, processing and structure of solid materials, mechanical properties of materials, chemical, electrical and magnetic properties of materials, etc.
  Details: Theory was taught in an online and asynchronous format (due to COVID-19), the laboratory was offered in an in-person format to two sections in Fall 2020, each with an average class size of 23 students

- *Metrology and Geometric Tolerancing*
  Description: Training on the fundamentals of geometric dimensioning and tolerancing, including metrology requirements, geometric tolerancing, calibration systems, gauge studies, measurement elements, analysis and presentation of measurement data, and quality implications
  Details: Offered in an online and asynchronous format (due to COVID-19) to two sections in Spring 2021, each with approximately 24 students
- *Thermodynamics and Heat Transfer*
  Description: Training on different forms of energy, particularly heat and work, the relationship between the properties of matter and energy, the basic laws of thermodynamics and their practical consequences, as well as the principles of heat transfer
  Details: Taught in an online and asynchronous format (due to COVID-19) in two sections in Spring 2021, each with an average class size of 19 students

☐ **Instructor of Record**   *January 2020 - May 2020*
Mechanical & Materials Engineering Department 🌐   *University of Cincinnati, Cincinnati, OH*

- *Applied Computational Methods Laboratory*
  Description: Practical application of numerical methods through MATLAB, for problems such as root-finding, interpolation, differentiation, integration, and solving differential equations
  Details: Initially taught in an in-person format to two sections, each with an average class size of 13 students; pivoted to an online synchronous format mid semester due to the the COVID-19 pandemic

☐ **Graduate Teaching Assistant**   *August 2018 - August 2020*
Mechanical & Materials Engineering Department 🌐   *University of Cincinnati, Cincinnati, OH*

- *Statics and Particle Dynamics*: Assisted instructors in a flipped classroom setting by attending every class session to answer students' questions; designed class projects; graded homework and project submissions

☐ **Graduate Teaching Assistant & Supplemental Instructor**   *August 2014 - May 2015*
Inamori School of Engineering 🌐   *Alfred University, Alfred, NY*

- *Additional Courses*: Assisted professors in courses such as Machine Design and Calculus I; and occasionally held lectures for MATLAB Programming course

Honors and Awards

☐ *Paper of Distinction* in Design Automation Conference in ASME IDETC for "Concurrent probabilistic control co-design and layout optimization of wave energy converter farms using surrogate modeling." Boston, MA 🌐   *August 2023*

☐ December *Engineer of the Month*, College of Arts and Science, University of Cincinnati, Cincinnati, OH 🌐   *December 2019*

Service and Leadership

☐ **Volunteer Reviewer**

- *National Science Foundation*:
  - ✝ Lead reviewer and reviewer in the Dynamics, Control and Systems Diagnostics (DCSD) program, 2023
  - ✝ Lead and panel reviewer in Trailblazer Engineering Impact Award, 2024

- *Journal Reviewer*:
  - † ASME: ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, ASME Open Journal of Engineering, Journal of Mechanical Design
  - † MDPI: Energies, World Electric Vehicle Journal, Mathematics, Sustainability, Processes, Electronics, Machines, biomimetics
  - † IEEE: Transactions on Vehicular Technology, Transactions on Control Systems Technology
  - † *Springer*: Structural & Multidisciplinary Optimization
  - † *Elsevier*: Reliability Engineering & System Safety
  - † *Others*: International Journal of Systems Science, International Journal of Robust and Nonlinear Control, Journal of Risk and Reliability
- Conference reviewer:
  - † *ASME*: International Design Engineering Technical Conference & Computers and Information in Engineering Conference (IDETC), International Mechanical Engineering Congress and Exposition (IMECE)
  - † *IEEE*: American Control Conference (ACC)

□ **Volunteer**
- Scott Undergraduate Research Experience (SURE) ⊕
- Graduate Student Showcase, Colorado State university, Fort Collins, CO ⊕
- Habitat for Humanity, TEDx Cincinnati, National Drive Electric Week
- IPALs: International Partners and Leaders, University of Cincinnati,
- MME-GSA: Mechanical and Materials Engineering Graduate Student Association,
- Equity and Inclusion Committee, University of Cincinnati, College of Engineering and Applied Science, University of Cincinnati ⊕

□ **Member**
- American Society of Mechanical Engineers (ASME)