Peter Walker Ferguson

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Research Interests

Robotics, Exoskeletons, Surgical Robotics, Grasping, Rehabilitation, Hardware Design.

Education

2015-present **Ph.D. in Mechanical Engineering, University of California, Los Angeles (UCLA)**

- Major: Design, Robotics, and Manufacturing. Minor: Dynamics. Advisor: Jacob Rosen.
- Thesis Title: Dual Reconfigurable Exoskeleton Hand System with Opposable Thumbs.
- Advancement to candidacy: July 22, 2020. Defense: June, 2022 (Expected).
- GPA : 3.97/4.00

2015-2017 **M.S. in Mechanical Engineering, UCLA**

- GPA : 3.97/4.00

2008-2012 **B.S. in Electrical Engineering, Loyola Marymount University (LMU)**

- Graduated from the University Honors Program.
- Senior Project: Designing, prototyping, and testing a low cost solar powered LED lamp with cell phone charging capabilities.
- GPA : 3.69/4.00.

Research Experience

July 2015-present **Graduate Researcher (UCLA)**

- Advisor: Prof. Jacob Rosen - Bionics Laboratory
- Projects:
  1. Design, manufacturing, testing, integration, and control of a robotic exoskeleton hand that attaches to existing upper limb exoskeletons for stroke rehabilitation.
  2. Automation of subtasks in robotic suturing and tissue manipulation.
  3. Development of a method for tissue identification during robotic cataract surgery.
  4. Editing of the book *Wearable Robotics: Systems and Applications*.

Jul 2013-Mar 2014 **Research and Development Engineer (Nonlinear Ion Dynamics)**

- Supervisor: Dr. Alfred Wong
- Projects:
  1. Modify, operate, and test high vacuum plasma chambers. Analyze the contents using residual gas analyzers, fast cameras, interferometry, and chemical etching of CR-39.
  2. Design and prototype a novel satellite ion propulsion system. Primary author of an approved grant for further research on the system.

Summer 2011 **Summer Intern (Southern California Edison Advanced Technology)**

- Projects:
  1. Create, document, and present test procedures for limiting the effects of blackouts and regulating the power factor as part of the Irvine Smart Grid Demonstration.
  2. Lab testing and analysis of a new device for substation bus animal deterrence.

Oct 2006-Aug 2008 **Research Assistant & Intern (Maryland Psychiatric Research Center)**

- Supervisor: Dr. Henry H. Holcomb.
- Project: Develop E-Prime tests to administer to healthy and schizophrenic patients in an fMRI to test decision making under the expectation of reward or punishment. Administer the tests to healthy volunteers outside of an fMRI. Statistically analyze the resulting data.

Teaching Experience

Aug 2019-Present — **Lecturer (LMU)**

- EECE 2110: Circuits I
  - Fall 2021.
- ELEC 210: Electric Circuit Analysis
  - Fall 2019, Fall 2020.

Oct 2016-Present — **Teaching Assistant (UCLA)**

- ENGR 182EW: Technology and Society.
  - Fall 2018.
- ENGR 183EW: Engineering and Society.
  - Fall 2017, Spring 2018, Summer 2018, Spring 2019, Summer 2020.
- MAE 102: Dynamics of Particles and Rigid Bodies.
  - Fall 2016, Winter 2017, Spring 2017.
- MAE 162D: Mechanical Engineering Design I.
  - Winter 2020, Winter 2021.
- MAE 162E: Mechanical Engineering Design II.
  - Spring 2020, Spring 2021.
- MAE 294A: Compliant Mechanism Design.
  - Winter 2018.

Aug 2014-Jun 2019 — **Tutor (Atelier Tutors)**

- Topics: Math, physics, SAT, chemistry.

April 2014-Feb 2016 — **Lead Robotics Teacher (STAR Education)**

- Summer teacher, after school teacher, and gifted and talented education teacher.
- Classes: robotics, LEGOs, coding, engineering, math, and art.

Awards and Honors

Jun 2021	2020-21 UCLA MAE Outstanding Teaching Assistant Award.
Aug 2020	2019-20 UCLA MAE Outstanding Teaching Assistant Award Honorable Mention.
Apr 2017	Best Poster Award in 2017 SoCal Robotics Symposium.
May 2012	Graduated Cum Laude from the University Honors Program of LMU.
May 2012	Recipient of the Daring Honey Badger Rescue Award.
Sep 2011	Membership in Tau Beta Pi, the national engineering honors society.
Sep 2011	Recipient of the A. Hannon Engineering Endowment Scholarship. Awarded $5,500.
Sep 2010	Recipient of the Page Science & Engineering Scholarship. Awarded $5,000.
May 2009-May 2012	Dean's List of the Seaver College of Science and Engineering of Loyola Marymount University.
Sep 2008	Recipient of the Arrupe Scholarship. Awarded $50,000.

Software Skills

Languages	MATLAB, C++, Assembly (Motorola and Intel), HTML5.
Software	SolidWorks, Multisim, LaTeX, Webots, EAGLE, LabView, PSpice, E-Prime.

Professional Memberships and Services

- Member of Institute of Electrical and Electronic Engineers (IEEE)
- Member of IEEE Robotics and Automation Society
- Member of American Society of Mechanical Engineers (ASME)
- Reviewer for IEEE Transactions on Robotics, IEEE Conference on Automation Science and Engineering, International Conference on Biomedical Robotics and Biomechatronics, International Symposium on Wearable Robotics
- 2020 SoCal Robotics Symposium organizing committee member

Publications (*denotes co-first authorship)

Books (Edited)

[B1] Jacob Rosen and Peter Walker Ferguson, Eds. *Wearable Robotics: Systems and Applications*, Academic Press, 2019, ISBN: 978-0-12-814659-0. DOI: https://doi.org/10.1016/C2017-0-01139-4.

Book Chapters

[BC1] Yang Shen, **Peter Walker Ferguson**, and Jacob Rosen, "Upper Limb Exoskeleton Systems - Overview," in *Wearable Robotics: Systems and Applications*, Jacob Rosen and Peter Walker Ferguson, Eds., Academic Press, 2020, pp. 1-22. DOI: https://doi.org/10.1016/B978-0-12-814659-0.00001-1.

[BC2] **Peter Walker Ferguson**, Yang Shen, and Jacob Rosen, "Hand Exoskeleton Systems - Overview," in *Wearable Robotics: Systems and Applications*, Jacob Rosen and Peter Walker Ferguson, Eds., Academic Press, 2020, pp. 149-175. DOI: https://doi.org/10.1016/B978-0-12-814659-0.00008-4.

[BC3] **Peter Walker Ferguson**, Brando Dimapasoc, and Jacob Rosen, "Optimal Kinematic Design of the Link Lengths of a Hand Exoskeleton," in *Wearable Robotics: Systems and Applications*, Jacob Rosen and Peter Walker Ferguson, Eds., Academic Press, 2020, pp. 193-206. DOI: https://doi.org/10.1016/B978-0-12-814659-0.00010-2.

[BC4] Hao Lee, **Peter Walker Ferguson**, and Jacob Rosen, "Lower Limb Exoskeleton Systems - Overview," in *Wearable Robotics: Systems and Applications*, Jacob Rosen and Peter Walker Ferguson, Eds., Academic Press, 2020, pp. 207-229. DOI: https://doi.org/10.1016/B978-0-12-814659-0.00011-4.

[BC5] Yang Shen, **Peter Walker Ferguson**, Ji Ma, and Jacob Rosen "Upper Limb Wearable Exoskeleton Systems for Rehabilitation: State of the Art Review and a Case Study of the EXO-UL8 Dual-Arm Exoskeleton System," *in Wearable Technology in Medicine and Healthcare*, Raymond Tong, Ed., Academic Press, 2018, pp. 71-90. DOI: https://doi.org/10.1016/B978-0-12-811810-8.00004-X.

Journal Papers

[J1] Sahba Aghajani Pedram*, **Peter W. Ferguson***, Matthew J. Gerber, Changyeob Shin, Jean-Pierre Hubschman, and Jacob Rosen, "A Novel Tissue Identification Framework in Cataract Surgery using an Integrated Bioimpedance-Based Probe and Machine Learning Algorithms," *IEEE Transactions on Biomedical Engineering (TBME)*, 2021, DOI: https://doi.org/10.1109/TBME.2021.3109246.

[J2] Sahba Aghajani Pedram*, Changyeob Shin*, **Peter Walker Ferguson**, Ji Ma, Erik P. Dutson, and Jacob Rosen, "Autonomous Suturing Framework and Quantification Using a Cable-Driven Surgical Robot," *IEEE Transactions on Robotics (TRO)*, 2020, pp. 1-14. DOI: https://doi.org/10.1109/TRO.2020.3031236.

Conference Papers

[C1] Sahba Aghajani Pedram*, **Peter Walker Ferguson***, Changyeob Shin, Ankur Mehta, Erik Dutson, Farshid Alambeigi, and Jacob Rosen, "Toward Synergic Learning for Autonomous Manipulation of Deformable Tissues via Surgical Robots: An Approximate Q-Learning Approach," in *8th International Conference on Biomedical Robotics and Biomechatronics (BioRob)*, 2020, pp. 878-884. DOI: https://doi.org/10.1109/BioRob49111.2020.9224421.

[C2] Changyeob Shin, **Peter Walker Ferguson**, Sahba Aghajani Pedram, Ji Ma, Erik P. Dutson, and Jacob Rosen, "Autonomous Tissue Manipulation via Surgical Robot Using Learning Based Model Predictive Control," in *IEEE International Conference on Robotics and Automation (ICRA)*, 2019, pp. 3875-3881. DOI: https://doi.org/10.1109/ICRA.2019.8794159.

[C3] **Peter Walker Ferguson***, Brando Dimapasoc*, Yang Shen, and Jacob Rosen, "Design of a Hand Exoskeleton for Use with Upper Limb Exoskeletons," in *International Symposium on Wearable Robotics (WeRob)*, Springer, 2018, pp. 276-280. DOI: https://doi.org/10.1007/978-3-030-01887-0_53.

[C4] Sahba Aghajani Pedram, **Peter Ferguson**, Ji Ma, Eric Dutson and Jacob Rosen, "Autonomous Suturing via Surgical Robot: An Algorithm for Optimal Selection of Needle Diameter, Shape, and Path," in *2017 IEEE International Conference on Robotics and Automation (ICRA)*, 2017, pp. 2391-2398. DOI: https://doi.org/10.1109/ICRA.2017.7989278.

Posters

[P1] Sahba Aghajani Pedram, **Peter Ferguson**, Ji Ma, Eric Dutson and Jacob Rosen, "Optimal Needle Diameter, Shape, and Path in Autonomous Suturing," in *2017 SoCal Robotics Symposium*, Los Angeles, California, 2017, arXiv:1901.04588.

[P2] H. H. Holcomb, S. Coates, J. West, **P. Ferguson**, and L. Oswald. "Reward and Punishment Expectations Modify Behavior and Brain Activity Patterns Associated with Visual Discrimination," 13th International Congress on Schizophrenia Research (ICOSR), Colorado Springs, Colorado, 2011.

Patents

[PAT1] **Ferguson, Peter Walker**. "Probe for Identification of Ocular Tissues During Surgery," U.S. Provisional Patent Application No. 63/210,256, filed: Jun 14, 2021. Patent pending.