

Kelilah Louise Wolkowicz, Ph.D.

John A. Paulson School of Engineering & Applied Sciences

Harvard University, Cambridge, MA, USA, 02138

☎ +1 (518) 569-7178 • ✉ kwolkowicz@seas.harvard.edu

🌐 <https://www.linkedin.com/in/kelilah-wolkowicz-739a9890/>

Professional Interests

Research Interests

Medical Robotics; Biomedical Device Design and Development; Rehabilitation and Assistive Device Design and Development; Robotics; Mechatronics; Automation; System Dynamics; Control Theory; Applied Linear and Nonlinear Control and Estimation; Neural Interfaces; Brain-Computer Interfaces

Teaching Interests

Dynamics; Dynamics Systems and Controls; Engineering Design; Estimation Theory; Feedback Control Systems; Human-centered System Design; Integration of Sensors, Actuators and Preprocessors; Kinematics and Dynamics; Kinematics, Dynamic Systems, and Controls; Mechanical Design; Mechatronics; Mobile Robot Design; Sensing and Sensors; Robotics

Research Experience

Postdoctoral Fellow

Jul. 2018 –

Harvard John A. Paulson School of Engineering and Applied Sciences, Cambridge, MA

Project: Biomedical Control of an Artificial Pancreas to Enhance Automated Insulin Delivery

Principal Investigators: Francis J. Doyle III, Ph.D., and Eyal Dassau, Ph.D.

Education

Doctor of Philosophy in Mechanical Engineering

2018

Master of Science: August 2016

The Pennsylvania State University, University Park, PA

Dissertation: Preparing the Automated Future for Wheelchair Users Through Motion

Prediction and User Input-Based Intent Inference

Committee: Sean N. Brennan, Ph.D.; Jason Z. Moore, Ph.D.; Bruce J. Gluckman, Ph.D.; Henry J. Sommer III, Ph.D.

Bachelor of Science in Mechanical Engineering

2012

Roger Williams University, Bristol, Rhode Island

magna cum laude, Honors, Minor in Mathematics

Publications and Presentations

Edited Book Chapter

K. Wolkowicz, F. J. Doyle, III, E. Dassau, "Control of Drug Delivery for Type 1 Diabetes Mellitus," *Springer Encyclopedia of Systems and Control*, under review.

Peer Reviewed Journal Publications

K. Wolkowicz, J. Pentzer, C. Miller, J. Moore, S. Brennan, "An Instantaneous Center of Rotation-Based Extended Kalman Filter Approach for the On-Line Estimation of Wheelchair Tire Slip," *ASME Journal of Dynamics Systems, Measurement and Control*.

K. Wolkowicz, J. Moore, P. McLaughlin, "Novel Pneumatic Device for High Speed Needle Insertion in Brachytherapy," *Journal of Medical Devices*, vol. 7, no. 3, p. 030945, 2013.

Peer Reviewed Conference Proceedings

K. Wolkowicz, R. Leary, J. Moore, S. Brennan, "Real-Time Path-Based Fusion of Spatial Databases with Temporal Control Inputs for Assistive Operation of Wheelchairs," to appear in *Proceedings of ASME 2019 Dynamic Systems and Control Conference* (Park City, UT).

K. Wolkowicz, R. Leary, J. Moore, S. Brennan, "Statistical Determination of Decision-Making Regions for Branching Paths: An Algorithm with a Wheelchair Assistance Application," to appear in *Proceedings of ASME 2019 Dynamic Systems and Control Conference* (Park City, UT).

K. Wolkowicz, R. Leary, J. Moore, S. Brennan, "Discriminating Spatial Intent from Noisy Joystick Signals for Wheelchair Path Planning and Guidance," in *Proceedings of ASME 2018 Dynamic Systems and Control Conference* (Atlanta, GA), V003T37A010.

T. Baum, **K. Wolkowicz**, S. Brennan, "Negative Obstacle Detection Using LiDAR Sensors for a Robotic Wheelchair," in *Proceedings of ASME 2018 Dynamic Systems and Control Conference* (Atlanta, GA), V003T37A011.

H. Sun, J. Liu, **K. Wolkowicz**, X. Zhang, B. Gluckman, "Low-Cost, USB Connected and Multi-Purpose Biopotential Recording System", in *Proceedings of IEEE Engineering and Medicine and Biology Society Conference 2018* (Honolulu, HI), pp. 4359-4362.

K. Wolkowicz, J. Pentzer, C. Miller, J. Moore, S. Brennan, "On-Line Estimation of Wheelchair Tire Slip Utilizing an Instantaneous Center of Rotation Extended Kalman Filter," in *Proceedings of ASME 2016 Dynamic Systems and Control Conference* (Minneapolis, MN), V001T06A002.

C. Miller, **K. Wolkowicz**, J. Safi, S. Brennan, "State of Charge Estimation for an Electric Wheelchair Using a Fuel Gauge Model," in *Proceedings of ASME 2016 Dynamic Systems and Control Conference* (Minneapolis, MN), V001T06A005.

A. Trezza, N. Virani, **K. Wolkowicz**, J. Moore, S. Brennan, "Indoor Mapping and Localization for a Smart Wheelchair Using Measurements of Ambient Magnetic Fields," in *Proceedings of ASME 2015 Dynamic Systems and Control Conference* (Columbus, OH), V003T42A005.

Presentations

K. Wolkowicz, H. Sun, A. Geronimo, Z. Simmons, B. Gluckman, J. Moore, S. Brennan. "Establishing a correlation between left/right brain signals and left/right joystick motion using simulated and real-world robotic wheelchair guidance," poster presented at the *4th ASU Rehabilitation Robotics Workshop*, Arizona State University, Tempe, AZ, Feb. 8-9, 2016.

K. Wolkowicz, "Novel Pneumatic Device for High Speed Needle Insertion in Brachytherapy," poster presented at the *2015 Design of Medical Devices Conference*, University of Minnesota, Minneapolis, MN, Apr. 2013.

Notable Projects

Postdoctoral Fellow: 'Development of a Microneedle-based Multi-sensor to Enhance Automated Insulin Delivery' Jul. 2018 –
Harvard John A. Paulson School of Engineering and Applied Sciences, Cambridge, MA

Principle Investigator: Eyal Dassau, Ph.D.

Researcher in the Doyle Group focusing on the biomedical control of an artificial pancreas system for automated insulin delivery for Type 1 diabetes (T1D).

- Automate treatment by artificially recreating the glucose-insulin feedback control loop.
- Integrate measurements of insulin with glucose concentration from interstitial fluid to derive and validate patient-specific glucose-insulin interaction models.
- Apply zone model predictive control to develop an algorithm that safely and effectively delivers insulin for healthy blood glucose management.
- Design and integrate an estimator to predict values of continuous glucose measurements, insulin, cortisol, and lactate to better determine appropriate insulin dosage in the context of T1D.

Graduate Research Fellow Masters/PhD Project: 'Preparing the Automated Future for Wheelchair Users Through Present Motion Prediction and User Input-Based Intent Inference' Jan. 2014 –
Dec. 2018

The Pennsylvania State University, University Park, PA | **Principle Investigator:** Sean Brennan, Ph.D.

Researcher in the Precision Medical Instrument Design Lab and the Intelligent Vehicles and Systems Group focusing on the design and control of an autonomous wheelchair platform with the integration of the following:

- Coordinated motion events with user decision-making measurements via dual joysticks and biopotentials.
- Implemented motion models for human control, open-loop kinematics, and closed-loop (PID) control.
- Created algorithms for obstacle detection and avoidance.
- Input/output monitoring via a joystick interface that can also be used in a simulated environment.
- External position estimates via high fidelity sensor systems.
- External position estimates via magnetometers; magnetic field measurements to quantify map variability.
- Software-based fault detection.

Worked in multi-disciplinary teams and collaborate with faculty from various programs, including:

- The Penn State Engineering Science and Mechanics Department
- The Penn State Center for Neural Engineering
- The Department of Neurosurgery within the Penn State College of Medicine at Hershey Medical Center

Graduate Research Fellow: 'Controlled Flexible Microneedle Insertion' Aug. 2012 –
Dec. 2013

The Pennsylvania State University, University Park, PA | **Principle Investigator:** Jason Moore, Ph.D.

Researcher in the Precision Medical Instrument Design Lab for the design of minimally invasive medical instruments focusing on minimizing the deflection of a silicon microneedle during tissue insertion in order to control insertion force and overcome microneedle structural material limitation.

- Measured deflection thresholds using an ultrasonic distance sensor in conjunction with a feedback system to prevent fracturing.
- Derived a mathematical model to calculate the deflection of a microneedle as a function of insertion force.

Graduate Research Fellow: 'Novel Pneumatic Device for High Speed Needle Insertion in Brachytherapy' Aug. 2012 –
May 2013

The Pennsylvania State University, University Park, PA | **Principle Investigator:** Jason Moore, Ph.D.

Researcher in the Precision Medical Instrument Design Lab for the design of minimally invasive medical instruments focusing on the design of a novel pneumatic device using high speed needle insertion to improve accurate needle placement in brachytherapy.

- Investigated insertion force experienced by tissue based on needle insertion speed using a high speed pneumatic device.
- Determined the optimum insertion speed to allow for improved needle placement accuracy.
- Summarized findings in technical poster presentation at the annual Design of Medical Devices (DMD) Conference at the University of Minnesota in Minneapolis.
- **Published: Journal of Medical Devices 7(3), 030945 (Jul 03, 2013)**

Materials Processing Center and Center for Materials Science and Engineering Research Intern: **Summer 2011**

'Injectable pH Dependent MR Sensors'

The Massachusetts Institute of Technology, Cambridge, MA | **Principle Investigator:** Michael Cima, Ph.D.

Research intern at the David H. Koch Institute for Integrative Cancer Research focusing on the fabrication of injectable hydrogel devices to be implanted in/around tumor cells via a simple injection with no surgical intervention or large bore needles required.

- Compared a snap-on device, polymer discs, and injectable polymer that gels in-situ.
- Characterized injectable hydrogel devices via measurements of pH response and MRI images.
- Summarized analysis and presented findings in technical poster presentation.

Institute for Energy and the Environment Environmental Design Contest: **Aug. 2011 – May 2012**

'PROTEUS: Pretreatment for Reverse Osmosis That is Effective, User-friendly, and Safe'

Roger Williams University, Bristol, RI and New Mexico State University, Las Cruces, NM

Senior thesis project that developed and demonstrated a more sustainable alternative to disposable filters for pretreating turbid water prior to reverse osmosis desalination.

- Process addressed particle size down to 0.1 microns.
- Process predicted to endure for at least four months upon sea-going ships.
- **Awarded 2nd place for best overall research paper and most scalable design.**

Teaching and Mentoring Experience

Teaching Experience

Teaching Fellow and Laboratory Instructor, Harvard University, Cambridge, MA **2019**

MS/MBA Engineering Sciences Technology Venture Immersion course, a newly designed intensive, hands-on, project-based course covering the engineering design process, as well as mechanical, electrical, and software prototyping.

- Restructured, planned, organized, and implemented the design of course format, including curriculum development, laboratory activities, homework assignments, team-based design projects, and enhancing lab and lecture structure.
- Discussion leader and instructor for mechanical engineering laboratory sections of ~30 students with hands-on experience emphasizing the course objectives.
- Created laboratory presentations and activity guides to connect hand-on activities with lecture material.

Teaching Assistant and Laboratory Instructor, The Pennsylvania State University, University Park, PA **2016 –2018**

ME 340 Mechanical Engineering Design Methodology, a fully revised course covering the design process, problem definition, conceptual design, system design, detail design, evaluation and testing, implementation, documentation, and communication.

- Restructured, planned, organized, and implemented the design of course format, including curriculum development, laboratory activities, homework assignments, semester-long projects, and enhancing lab and lecture structure.
- Discussion leader and teacher for two laboratory sections of ~30 students with hands-on experience emphasizing the course objectives for five semesters.
- Created laboratory presentations and activity guides to connect hand-on activities with lecture material.

Scientific Writing and Presentation Instructor, The Pennsylvania State University, University Park, PA **Summer 2017**

Penn State's Leonhard Center for Enhancement of Engineering Education in collaboration with the Simula School of Research an Innovation (SSRI) and the University of Oslo, Norway

- Edited ten scientific papers (literature reviews, conference papers, journal papers, and PhD dissertations).
- Edited 13 written grant proposals.
- Reviewed and provided feedback for four proposal presentations.

- Instructed a workshop designed to help graduate students make their research communications more understandable, memorable, and persuasive.

Teaching Assistant, The Pennsylvania State University, University Park, PA **Fall 2015**
 ME/IE 456 Induction Robot Applications, an introduction to robotics with emphasis on robot selection, programming, and economic justification for manufacturing applications.

- Demonstrated fieldwork techniques and assisted in preparing and presenting lectures.
- Explained the challenges of integrating sensor systems and reference coordinate transformations with robotic systems and designed a complimentary lab component for the final project.
- Evaluated homework, quizzes, exams, and lab milestones; held office hours to ensure students understand course concepts.

Science Tutor, *Roger Williams University*, Bristol, RI **2011 – 2012**
 Tutor for Physics I & II, Chemistry I & II, and Biology I.

Hebrew/Religious School Teacher, *Temple Beth Israel Rabin Religious School*, Plattsburgh, NY **2005 – 2008**
 Created weekly lesson plans to teach children ages 4-13 the Hebrew Aleph-Bet and used that knowledge to read and write Hebrew words and phrases; introduced and reviewed the moral concepts related to religious stories.

Pedagogical Training

Participant in Rising Stars in Mechanical Engineering Workshop **2018**
 Hosted by the *Massachusetts Institute of Technology*, Cambridge, MA

Practical Ideas for Improving your Teaching Goals & Strategies: Active Learning and Backward Design **2018**
 FAS Office for Postdoctoral Affairs, *Harvard University*, Cambridge, MA

Promoting Diversity and Inclusion in STEM Voices for Diversity in STEM Speaker Series **2018**
 Project on Race & Gender in Science & Medicine, *Hutchins Center and Harvard University*, Cambridge, MA

Community Engaged Learning in Engineering Science of Learning Speaker Series **2018**
 SEAS Learning Incubator, *Harvard University*, Cambridge, MA

Lecturing Can Be Active Learning: A New Evidence-Based Approach to an Old Debate **2018**
 Schreyer Institute for Teaching Excellence, *The Pennsylvania State University*, University Park, PA

The Future of Mechatronics & Robotics Education (FoMRE) Workshop **2018**
Dynamic Systems and Controls Conference, Atlanta, GA

Lecturing Can Be Active Learning: A New Evidence-Based Approach to an Old Debate **2018**

Ten Tips for Getting Started with Teaching Workshop **2018**

Teaching So All Your Students Are Included Workshop **2018**

Feeling Like a Fake: Overcoming the Imposter Phenomenon Workshop **2018**

Handling Challenging Situations in the Classroom Workshop **2018**

Getting through the Stack: Grading Fairly and Efficiently Workshop **2018**

Preparing a Teaching Demo for a Job Interview Workshop **2018**

Writing your Teaching Philosophy Statement Workshop **2017**

Schreyer Institute for Teaching Excellence, *The Pennsylvania State University*, University Park, PA

Participant in NextProf Fall Engineering Workshop **2015**
 Hosted by *University of Michigan College of Engineering*, Ann Arbor, MI

Advising and Mentoring Experience

Director and Mentor for over 10 Undergraduate Research Students The Doyle Group, <i>Harvard University</i> , Cambridge, MA Penn State Intelligent Vehicles and Systems Group, <i>The Pennsylvania State University</i> , University Park, PA	2014 – 2019
<ul style="list-style-type: none"> – Supervised and mentored at least three undergraduate researchers and interns per semester. – Outlined research plans and undergraduate theses; edit publications and theses. – Provided weekly individual instruction, guidance, and research assistance. 	
Student Advocate , <i>Roger Williams University</i> , Bristol, RI Mentored freshman and sophomores through their transition into college.	2010 – 2012

Fellowships and Awards

Fellowships

Gabron Graduate Fellowship in Mechanical Engineering	2016
National Science Foundation Graduate Research Fellow	2012 – 2015

Academic Recognition

Council of Graduate Schools GradImpact: Improving Mobility for Wheelchair Users through SMART Technology Nominated and chosen based on PennState Mechanical and Nuclear Engineering PhD research article	2018
NMSU Institute for Energy and the Environment Environmental Design Contest Awarded 2 nd place for best paper and most scalable design	2012
Alpha Chi National College Honor Society – top 5% of students in Engineering	2010 – 2012
Kappa Mu Epsilon Math Honor Society	2010 – 2012
Roger Williams University Dean’s List ; Roger Williams University Honors Program (distinguished scholarly achievement); Provost Scholarship (distinguished scholarly achievement); Leadership Award (academic achievement and substantial dedication to creating an inclusive community)	2008 – 2012

Professional Service

Leadership Experience

President , Mechanical and Nuclear Engineering Graduate Student Council	2016 – 2017
Chair of Athletics and Social Events , Mechanical and Nuclear Engineering Graduate Student Council	2014 – 2016
Vice President , Society of Women Engineers Roger Williams University Chapter	2010 – 2012
Secretary , Presidential Student Ambassadors Representative of the school and the office of the university president, worked campus events.	2009 – 2012
Engineering Ambassador Assisted with tours and information sessions for perspective students and their families.	2009 – 2012

Educational Outreach

Cambridge 8th Grade Science & Engineering Showcase Invited speaker for two groups of 200 middle school students on the “nonlinear trajectories” from middle school to college and beyond, as well as on current state-of-the-art artificial pancreas systems	2019
Discovery Space stEMPOWERed Girls Designed easy-to-understand hands-on mechatronics and virtual environment activities to promote Mechanical Engineering to an after school girl’s program.	2018
Penn State Exploration-U	2014 – 2018

Designed easy-to-understand hands-on activities to promote STEM education in local schools.

Penn State Artificial Intelligence vs. Science-U Summer Camp

2014 – 2015

Assisted with teaching programming and ground robotic control algorithms to high school students.

Volunteer at Shaver's Creek Environmental Center

2013 – 2018

Volunteer for the annual Fall Harvest Festivals, Maple Harvest Festivals, and general trail maintenance.

Professional Memberships

The New York Academy of Sciences

2017 –

American Society of Mechanical Engineers (ASME)

2011 –

Institute of Electrical and Electronics Engineers (IEEE)

2011 –

Society of Woman Engineers (SWE)

2008 –