# Antonio Alvarez Valdivia

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## PROFESSIONAL SUMMARY AND RESEARCH INTERESTS

PhD Candidate in Mechanical Engineering with over 5 years of research experience in haptics, robotics, and human-machine interaction. Expertise in designing, prototyping, and controlling pneumatically actuated soft robotic systems that provide real-time haptic feedback in wearable and shape-changing interfaces. General research interests include haptics, HRI, soft robotics, mechatronics, and human factors in engineering. Actively seeking full-time employment opportunities starting December 2025.

## EDUCATION

Purdue University – West Lafayette, Indiana — Expected December 2025
- Ph.D. in Mechanical Engineering | *Advisor: Laura H. Blumenschein* — GPA: 3.78/4.00

Iowa State University – Ames, Iowa — Graduation Date: May 2021
- Bachelor of Science in Mechanical Engineering — GPA: 3.86/4.00

Des Moines Area Community College – Ankeny, Iowa — Graduation Date: May 2018
- Pre-Engineering (Transfer Program) — GPA: 4.00/4.00

## RESEARCH EXPERIENCE

**Graduate Student Researcher** — Aug 2021 – Present

*Purdue University, Mechanical Engineering* — *Advisor: Laura H. Blumenschein*

*Thesis Title: Design, Control and Usability Analysis of Ubiquitous Haptic Interfaces for Human-Machine Interaction*

- Designed and prototyped pneumatically actuated haptic interfaces for robot-to-human communication, wearable feedback, and shape-changing displays.
- Developed fluidic logic circuits for electronics-free control of soft haptic systems, enabling reliable, reconfigurable signal routing, and feedback modularity.
- Led a user study on algorithmic personalization of haptic interfaces, combining modular hardware and information-theoretic optimization to improve task performance across users.
- Engineered and characterized a soft growing pin actuator with 308% extension, integrating sensors and validating performance through model-based analysis.
- Implemented full-stack mechatronics and conducted dynamic system analysis for soft robotic devices; integrated psychophysiological measures and motion capture into usability studies.
- Published in top venues including IEEE Transactions on Haptics, IEEE RoboSoft, and IJRR.

**Research Intern** — May 2025 – Present

*Massachusetts Institute of Technology, Lincoln Laboratory*

- Human Resilience Technology Group, Biotechnology and Human Systems (Division 2)
- Contributed to SPROUT, a vine-inspired continuum robot designed for navigating through rubble to support search-and-rescue operations.
- Implemented ROS2-based control architecture on NVIDIA Jetson Nano; integrated sensors and mechanical subsystems for robot actuation and tip-mounted camera feedback.
- Redesigned and validated a fabrication protocol for the soft growing body, reducing fabric usage by 70% and enabling 3x faster eversion through lower body friction.
- Developed a modular testbed to characterize effects of payload and tension on growth dynamics.

- Planned future work involving reproducibility benchmarking and human factors studies with first responders interacting with the robot in simulated rubble environments used for first responder training.

**Visiting Researcher** Oct 2023 – Nov 2023

*Virginia Tech, Mechanical Engineering* *Advisor: Dylan Losey*

- Created experimental protocols for a user study on human-robot interaction.
- Designed a pneumatically actuated wearable haptic bracelet as a communication interface.
- Developed an AR Unity application on Microsoft Hololens for visualizing robot waypoints.
- Implemented multimodal interfaces, combining visual and haptic feedback to show robot motion.

**Undergraduate Research Assistant** Jun 2018 – Dec 2020

*Iowa State University, Mechanical Engineering* *Advisor: Jaime J. Juarez*

- Constructed and evaluated portable microscopy devices for microrheology measurements.
- Designed prototypes and testing hardware for colloidal science experiments.
- Collected video data using microscopes and analyzed/processed it on MATLAB.

**Summer Undergraduate Research Assistant** May 2019 – Aug 2019

*University of Pennsylvania, Mechanical Engineering and Applied Mechanics* *Advisor: Kevin T. Turner*

- Fabricated capacitive, force sensing cells with copper films and PDMS and Ecoflex substrates.
- Designed digital electronic circuit to measure small changes in capacitance.
- Evaluated and experimentally characterized sensors.

## TECHNICAL SKILLS

- **Fabrication and Testing:** Mechanical design and assembly, 3D printing, CAD and GD&T, hand tools, laser cutting, soldering, force gage testing, silicone elastomer fabrication, rapid iteration, machine shop techniques.
- **Robotics and Control Systems:** Modeling, control systems integration, PID, observer design, system ID, real-time sensor integration, electronic circuit design, motor selection and integration within robotic and mechatronic systems, Franka Research 3.
- **Software:** MATLAB, Python (PyTorch, TensorFlow, Pandas, NumPy, and more), C++, C#, Arduino, SolidWorks, AutoCAD, IBM SPSS Statistics, JMP, Simulink, motion tracking systems, Linux, ROS2, basic Unity development (AR & VR) for Microsoft HoloLens and Meta Quest.
- **Data Analytics** – Machine Learning (Supervised and Unsupervised), Regression Analysis, Statistics, Probability, Experimental Design.
- **Research:** Report writing, data collection, statistical analysis, human factors research and psychophysics, IRB protocols, planning, and scheduling.

## PUBLICATIONS

*Journal Articles:*

J1. **Alvarez Valdivia, A.**, Christie, B.H., Losey, D.P., and Blumenschein, L.H. (2025) *A Modular Haptic Display with Reconfigurable Signals for Personalized Information Transfer.* (Under Review). arXiv:2506.05648

J2. Huang, B., Wang, Z., Cheng, Q., Ren, S., Cai, H., **Alvarez Valdivia, A.**, Mahadevan, K., Wigdor, D. (2025) *AeroHaptix: A Wearable Vibrotactile Feedback System for Enhancing Collision Avoidance in UAV Teleoperation*. IEEE Robotics and Automation Letters. DOI: 10.1109/LRA.2025.3548866

J3. Habibian, S., **Alvarez Valdivia, A.**, Shailly, Blumenschein, L.H. and Losey, D.P. (2024) *A Survey of Communicating Robot Learning during Human-Robot Interaction*. International Journal of Robotics Research. DOI:10.1177/02783649241281369

J4. **Alvarez Valdivia, A.**, Habibian, S., Mendenhall, C.A., Fuentes, F., Shailly, R., Losey, D.P. and Blumenschein, L.H. (2023) *Wrapping Haptic Displays Around Robot Arms to Communicate Learning*. IEEE Transactions on Haptics. DOI: 10.1109/TOH.2023.3240400 ***(2024 IEEE Transactions on Haptics Best Application Paper Award)***

J5. Shabaniverki, S., **Alvarez Valdivia, A.** and Juárez, J.J. (2021) *3D printed self-propelled composite floaters*. Smart Materials and Structures. DOI: 10.1088/1361-665X/ac01a9

J6. Shabaniverki, S., **Alvarez Valdivia, A.** and Juárez, J.J. (2019) *Portable imaging viscometry for quantitative complex fluid measurements*. Experimental Thermal and Fluid Science. DOI: 10.1016/j.expthermflusci.2019.05.009

*Refereed Conference Articles:*

C1. Wang, S., Frias-Miranda, E., **Alvarez Valdivia, A.**, and Blumenschein, L.H. (2025) *Anisotropic Stiffness and Programmable Actuation for Soft Robots Enabled by an Inflated Rotational Joint*. 2025 IEEE International Conference on Robotics and Automation (ICRA). arXiv:2410.13003

C2. **Alvarez Valdivia, A.**, Rezqalla, Mohammad A., Swann, Sarah E., and Blumenschein, L.H. (2023) *Soft Growing Pin for High-Extension Shape-Changing Displays*. 2024 IEEE International Conference on Soft Robotics (RoboSoft). DOI: 10.1109/RoboSoft60065.2024.10522001

C3. **Alvarez Valdivia, A.** and Blumenschein, L.H. (2023) *Perception of and Response to a Haptic Device as a Function of Signal Complexity*. 2023 IEEE World Haptics Conference (WHC). DOI: 10.1109/WHC56415.2023.10224490

C4. **Alvarez Valdivia, A.**, Shailly, R., Seth, N., Fuentes, F., Losey, D.P. and Blumenschein, L.H. (2022) *Wrapped haptic display for communicating physical robot learning*. 2022 IEEE 5th International Conference on Soft Robotics (RoboSoft). DOI: 10.1109/RoboSoft54090.2022.9762210.

## PRESENTATIONS

*Oral Presentations*

1. “Perception of and Response to a Haptic Device as a Function of Signal Complexity,” Oral Presentation in 2023 IEEE World Haptics Conference (WHC). Delft, Netherlands.
2. “Portable Imaging Viscometry for Quantitative Complex Fluid Measurements.” In 2020 14th ISU Symposium on Undergraduate Research and Creative Expression. Iowa State University. Ames, IA.
3. “Portable Imaging Viscometry for Quantitative Complex Fluid Measurements.” in 2020 22nd Texas National McNair Research Conference. University of North Texas. Denton, TX.
4. “Flexible Capacitive Force Sensors for use in Robotic Grippers,” in Summer 2019 REU Symposium. University of Pennsylvania. Philadelphia, PA.

*Poster Presentations*

1. “Soft Growing Pin for High-Extension Shape-Changing Displays,” in 2024 IEEE International Conference on Soft Robotics (RoboSoft). San Diego, CA.
2. “Wrapping Haptic Displays Around Robot Arms to Communicate Learning,” in 2023 IEEE International Conference in Robotics and Automation (ICRA). London, UK.
3. “Wrapping Haptic Displays Around Robot Arms to Communicate Learning,” in 2023 Inaugural ICON Student Research Conference. Purdue University. West Lafayette, IN.
4. “Wrapped haptic display for communicating physical robot learning,” in 2022 IEEE 5th International Conference on Soft Robotics (RoboSoft). Edinburgh, Scotland.

5. “555-timer Flexible Circuit,” in 2019 McNair Program Research Symposium. Iowa State University. Ames, IA.
6. “Portable Imaging Viscometry for Quantitative Complex Fluid Measurements,” in Summer 2018 REU Symposium. Iowa State University. Ames, IA.

## TEACHING, LEADERSHIP & SERVICE

**Peer Reviewer**

- IEEE Robotics and Automation Letters
- ACM Transactions on Human-Robot Interaction
- 2025 IEEE International Conference on Soft Robotics (RoboSoft)
- 2024 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)

**Graduate Student Mentor** | RAAD Lab, Purdue University ME Aug 2021 – Present

- Mentored nine undergraduate students in semester-long soft robotics and haptics research projects.

**General Co-Chair** | 3rd ICON Student Research Conference Jun 2024 – Feb 2025

- Student-run conference at Purdue’s Institute for Control, Optimization and Networks (ICON).
- Led conference organization, program, and logistics.
- Secured $4,000 in sponsorship from the IEEE CSS Diversity, Outreach & Development Activities Board and $4,000 from Purdue’s ICON to fund the conference.

**Vice President** | OMEGA (Mechanical Engineering Graduate Association) May 2024 – May 2025

- Represented OMEGA at Purdue Engineering GSA Committee Meetings
- Organized major social and networking events for ME graduate students, faculty, and staff.

**Diversity Officer** | OMEGA (Mechanical Engineering Graduate Association) Jan 2022 – May 2023

- Organized major social and networking events for ME graduate students, faculty, and staff.
- Represented Purdue ME department in graduate school diversity recruitment programs.

**Logistics Co-chair** | 2nd ICON Student Research Conference Oct 2023 – April 2024

- Student-run conference at Purdue’s Institute for Control, Optimization and Networks (ICON).
- Assisted with location, programming, and banquet reservations.

**Volunteer** | Purdue Women in Engineering Program Nov 2021 – Dec 2024

- Assisted in engineering workshops and short courses directed by Prof. Blumenschein (RAAD Lab) in programs hosted by Purdue’s Women in Engineering (WiE).

**Undergraduate Teaching Assistant** | Iowa State University Aug 2020 – Dec 2020

- Grading duties for assignments, exams, and final projects for ME 325: Mechanical Component Design.

**International Student Orientation Leader** | Iowa State University Jun 2019 - Aug 2019

- Led orientation for groups of international students for the International Students and Scholars Office.
- Assisted with registration, English placement, and immigration processes.
- Exemplified respectful practices and communication with multicultural, international students.
- Organized group activities and discussions facilitation

**Peer Mentor** | Iowa State University Sep 2018 – May 2021

- Engineering Admissions Partnership Program for Engineering Student Services.
- Communicate with prospective transfer students.

- Network with industry partners and student organizations to feature articles in monthly newsletters.

**Summer School Teacher** | Ames Community School District June 2017 – July 2017

- Created *Engineering 101* course curriculum.
- Taught 6-week summer school course for 1st - 6th grade students.

## HONORS AND AWARDS

- 2024 IEEE Transactions on Haptics Best Application Paper Award
- 2024 Preparing Future Faculty (PFF) Program Scholar, Purdue Graduate School
- NSF Graduate Research Fellowship, 2022
- Purdue Frederick N. Andrews Fellowship, 2021
- Purdue Graduate Bridge Program Fellow, 2021
- Iowa State University MSA Academic Excellence Award, 2020
- Tau Beta Pi Engineering Honor Society, February 2020
- Ronald E. McNair Outstanding First Year Scholar, May 2019
- Ronald E. McNair Scholar, 2018