Antonio Alvarez Valdivia

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PROFESSIONAL SUMMARY AND RESEARCH INTERESTS

More than 5 years of research experience in soft robotics, haptics, mechatronics, human-robot interaction, and microfluidics. Current research endeavors include *soft haptic interfaces for HRI* and robot learning, and development of *shape-changing interfaces* (inflatable soft pin arrays) for *human-machine interaction*. General research interests include haptics, HRI, soft robotics, mechatronics, and human factors in engineering. Actively seeking full-time employment opportunities starting after graduation in July 2025.

EDUCATION

Purdue University – West Lafayette, Indiana   Graduation Date: July 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

- <u>Wrapped Haptic Display to Communicate Robot Learning</u> (Aug 2022 – Present)
  - Designed and manufactured pneumatically actuated soft haptic interfaces.
  - Evaluated a variety of soft and compliant materials such as LDPE, TPU, fabrics, and elastomers.
  - Designed experimental protocols for human subject and user studies.
  - Collected psychophysiological data related to haptic perception and performed statistical analysis.
- <u>Inflatable Soft Growing Pin for Dynamic Shape-Changing Displays</u> (May 2023 – Present)
  - Developed a compact, pneumatically actuated soft growing pin capable of growing 18.5cm (308% extension).
  - Designed experimental protocols for the characterization of the device.
  - Constructed a preliminary demonstration of a pin array to demonstrate the feasibility of the display concept.
- <u>Soft Fluidic Logic Control Systems for Pneumatically Actuated Haptic Interfaces</u> (May 2024 – Present)
  - Implemented soft fluidic valves fabricated with elastomers and 3D printing to enhance control of pneumatically actuated interfaces.

- · Characterized the dynamic response of fluidic valves to determine usability and control.
- · Created novel control mechanisms to reduce dependence on electro-pneumatic equipment, simplifying the overall interface architecture.
- <u>Signal Complexity Effects on the Task-based Utility of Haptic Information</u> (Aug 2022 – Present)
    - · Designed an experiment to measure the differences between perception and use as it relates to signal complexity.
    - · Created a holdable soft haptic device to provide navigation directions with varied complexity.
    - · Integrated a motion capture system to quantitively measure the tradeoffs between complexity and usability of haptic feedback.

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, electronic circuit design and evaluation, force gage testing, silicone elastomer fabrication and basic wet lab procedures.
- **Computer:** MATLAB, Python, Arduino, SolidWorks, AutoCAD, IBM SPSS Statistics, Multisim, CoppeliaSim/V-REP, motion tracking systems, basic Linux, ROS2, basic Unity development (AR & VR) for Microsoft HoloLens and Meta Quest.
- **Research:** Report writing, data collection, statistical analysis, human factors research and psychophysics, IRB protocols, planning, and scheduling.

PUBLICATIONS

Journal Articles:

J1. Huang, B., Wang, Z., Cheng, Q., Ren, S., Cai, H., **Alvarez Valdivia, A.**, Mahadevan, K., Wigdor, D. (2024) *AeroHaptix: A Wearable Vibrotactile Feedback System for Enhancing Collision Avoidance in UAV Teleoperation.* (Under Review)

J2. 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

J3. **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)***

J4. 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

J5. 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

Referred Conference Articles:

C1. Wang, S., Frias-Miranda, E., **Alvarez Valdivia, A.**, and Blumenschein, L.H. (2024) *Anisotropic Stiffness and Programmable Actuation for Soft Robots Enabled by an Inflated Rotational Joint.* (Under Review)

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

Graduate Student Mentor | RAAD Lab, Purdue University ME   Aug 2021 – Present
- Mentored eight undergraduate students in semester-long soft robotics and haptics research projects.

Organizing Committee | 3rd ICON Student Research Conference   Jun 2024 – Present
- Student-run conference at Purdue's Institute for Control, Optimization and Networks (ICON).
- General Co-chair. Assisting with initial planning of conference dates, program, and arrangements.
- Secured $4,150 from the IEEE CSS Diversity, Outreach & Development Activities Board to partially fund the conference.

Vice President | OMEGA (Official Mechanical Engineering Graduate Association)   Jun 2024 - Present
- Represented OMEGA at Purdue Engineering GSA Committee Meetings
- Organized major social and networking events for ME graduate students, faculty, and staff.

Diversity Officer | OMEGA (Official 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.

Organizing Committee | 2nd ICON Student Research Conference   Oct 2023 – Present
- Student-run conference at Purdue's Institute for Control, Optimization and Networks (ICON).
- Logistics Co-chair. Assisted with location, programming, and banquet reservations.

Volunteer | Purdue Women in Engineering Program   Nov 2021 – Present
- 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
- Ronald E. McNair Scholar, 2018
- Tau Beta Pi Engineering Honor Society, February 2020
- Ronald E. McNair Outstanding First Year Scholar, May 2019