

Tomasz P. Trzpit

Curriculum Vitae, updated 04/01/2026

ttrzpit@u.northwestern.edu

Phone: +1 (773) 344 5727

PROFESSIONAL PROFILE

I am a Ph.D. candidate in Mechanical Engineering at Northwestern University who believes that engineering education should not only teach students how to build robust systems, but also why those systems matter for the people who use them. My teaching emphasizes human-centered design, encouraging students to consider usability, accessibility, and real-world context alongside technical performance. This perspective has been shaped through my doctoral research, which culminated in the NURing, a tendon-driven wearable device that enables eyes-free kinesthetic guidance through fingertip deflection, resulting in several publications and a pending patent. My dual interests in robotics and assistive technology have shaped how I approach teaching courses in mechatronics, mechanical design, and rapid prototyping not just to engineering students, but also non-STEM majors. By guiding students through hands-on assignments and projects that move from concept to physical prototype, I aim to help them see engineering not just as analysis, but as a process of creating technologies that can meaningfully expand our capabilities.

EDUCATION

Northwestern University | Ph.D. in Mechanical Engineering GPA: 3.7/4.0 | June 2026

Dissertation: Guidance and Navigation through Kinesthetic Fingertip Deflection Cues

Advisor: J. Edward Colgate, Ph.D.

Relevant Courses: Advanced Mechatronics, Designing Product Interactions, Embedded Systems in Robotics, Human Perception and Electronic Media, Micromanufacturing

Stanford University | Master of Science in Mechanical Engineering GPA: 3.9/4.0 | June 2020

Specializations: Robotics and Kinematics, Manufacturing and Product Realization

Relevant Courses: Computer-Aided Product Creation, Design and Control of Haptic Systems, Design for Extreme Affordability, Medical Robotics, Orthopedic Bioengineering, Principles of Robot Autonomy, Techniques of Failure Analysis

Stanford University | Bachelor of Science in Mechanical Engineering GPA: 3.5/4.0 | June 2020

Relevant Courses: Introduction to Mechatronics, Mechanical Engineering Design Practicum, Perspectives in Assistive Technology, Precision Engineering, Science and Engineering Course Design

Awards: Notation in Science Communication

City Colleges of Chicago | Associate Degree in Science GPA 4.0/4.0 | May 2015

Fellowships: NASA High Altitude Ballooning Research (NASA-HAB 2015)

Awards: Presidential Scholar Award, Emerging Student Leader Award, Legacy Award

EXPERTISE & INSTRUCTION SYNOPSIS

Areas of Expertise

Mechanical Design & Prototyping, Embedded Systems, Haptics, Human-Computer Interaction, Fabrication.

Courses Qualified to Teach

Additive Manufacturing, Assistive Device Design, Computer-Aided Design (CAD), Electronics / Circuit Design, Embedded Systems, Engineering Ethics, Fabrication (Metalworking, Woodworking), Introductory Robotics, Mechatronics, Rapid Prototyping, Wearable Device Design.

Curriculum Design and Delivery

Designed and delivered course content at both the undergraduate and graduate levels, spanning lecture, project-based capstone instruction, hands-on fabrication, and online/hybrid formats. Developed assignments, rubrics, lab curricula, and projects across multiple courses; assumed co-primary instructional responsibility for Robot Design Studio (ME 472, Northwestern, Spring 2023); coordinated guest lecturers from industry.

TEACHING EXPERIENCE

Robot Design Studio | Co-Instructor

Northwestern University | Winter & Spring 2023 & 2024

- Served as a course assistant and then as a co-instructor across two offerings of a 20-student mechanical engineering capstone course, supporting projects including multi-DOF haptic interfaces and a 5-DOF robot arm with series-elastic actuators.
- Verified mechanical designs and fabrication, ensured electrical and mechanical subsystem safety, coordinated project documentation, and supported ABET accreditation compliance.
- Developed and delivered lectures on mechanical design best practices and team dynamics; coordinated industry guest lecturers; developed and graded student assignments.

Electronics Design | Teaching Assistant

Northwestern University | Fall 2023

- Tutored students in introductory electrical design and circuit analysis as well as performing hands-on demonstrations during group study sessions.
- Graded over 1,400 assignments for a class of 130 students, plus midterm and final exams; I was also responsible for ensuring that the grading team performed consistently, aiding students in resolving any course grievances.

Foundations of Product Realization | Course Assistant

Stanford University | Spring 2020

- Re-designed a project-based design course into a fully online format during COVID, coordinating asynchronous instruction for over 100 on-campus and international students, including sourcing and shipping prototyping materials worldwide. Additionally, re-worked the course final project for an online format, where students built a virtual "marble run" segment in SolidWorks, ran rigid-body simulations to verify functionality, and then integrated their segments into a collaborative group assembly
- Led lectures and study sessions in visual communication through sketching, orthographic projection, and CAD (SolidWorks).

Additive Manufacturing | Course Assistant

Stanford University | Summer 2019

- Developed various assignments and course projects for a graduate-level course of 30 students focusing on various methods of additive manufacturing (FDM, SLA, SLS).
- Designed and fabricated testbeds for 3D-printed water pipe fittings, tensile coupons, and metamaterials, which were then used in competitions to evaluate student designs.

Stanford Product Realization Lab | Course Assistant

Stanford University | 2018 - 2020

- Taught structured metalworking labs that taught machine lathe and conversational mill use, in addition to oxyacetylene-gas welding and wood turning labs. Lab size was 6-7 students, occurring several times during the quarter. Additionally, mentored 3-4 students during each quarter, with a focus on novel product design and successful fabrication.
- Specialized in rapid prototyping, with a focus on design for fabrication and design for 3D printing using FDM and SLA technologies, as well as prototyping using laser cutting and soft textiles.
- Concurrently served as classroom assistant for Introduction to Product Realization as part of position.

Smart Robots in the Mix | Teaching Assistant

Stanford University | Spring 2016, 2017, 2018

- Served as a member of the teaching team for three offerings, leading lectures on robotics, human-robot interaction, and robot ethics aimed at introducing technical topics to non-STEM majors.
- Coordinated with instructors and special guests to provide classroom resources, online teaching materials, and assignments for a class of 14-20 students. I personally developed the mid-term and final projects for the course, along with relevant documentation and grading rubrics.

Engineering Projects | Teaching Assistant

City Colleges of Chicago | Fall 2014

- Helped to design and teach an engineering capstone course for 15 students utilizing the Lego Mindstorms EV3 robotics platform, teaching students the concepts behind robot design, programming, and assembly.
- Prepared classroom materials and developed the final project involving chase-and-evade robot behaviors.

RESEARCH EXPERIENCE

Northwestern Haptics Lab | Ph.D. Thesis Research Northwestern University | June 2020 – June 2026

- Developed the *NURing*, a tendon-driven wearable device that enables eyes-free peripersonal and navigational guidance through kinesthetic cues rendered via fingertip deflection. These cues have been shown to allow precise fingertip guidance during hand reach while requiring minimal cue decoding. Additionally, the device's form factor and feedback modality further allow for intuitive guidance without impeding tactile sensing or hand dexterity.
- Developed a camera-based closed-loop guidance system integrating real-time ArUco marker pose estimation, coordinate transform pipelines, and embedded motor control to guide users' hands towards objects eyes-free and provide guidance cues for environmental navigation.
- Designed and implemented the full mechatronics stack: tendon-driven actuation mechanism, custom embedded firmware, host-side vision processing pipeline, and microcontroller-Linux communications.
- Conducted IRB-approved user studies with participants who have visual impairments, evaluating guidance performance across target acquisition and object retrieval tasks in real-world environments.
- Resulted in four peer-reviewed publications (IEEE World Haptics 2025, ACM CHI 2026 (x2), IEEE Transactions on Haptics under review), and a filed patent.
- Co-developed a circuit that generates high-speed (20kHz), high-voltage ($\pm 220V$, 10mA) waveforms to drive electroadhesive brakes and clutches used in our lab's research.

CHARM Lab | Research Assistant Stanford University | Spring 2019 – Fall 2019

- Designed and fabricated a magnetically-coupled robotic crawler that actuated at the end of a soft extensible vine robot, allowing for the end-effector to extend or retract under its own power.
- Improved the production of cable-driven soft vine robots, with a focus on creating a geometry that results in predictable robot behavior.

Design for Extreme Affordability | Student Researcher Stanford University | Winter – Summer 2018

- Worked in a team collaborating with Rare Brazil to identify key barriers to harvest profitability for crab fishermen, finding post-catch spoilage during unrefrigerated storage was the primary source of income loss for economically vulnerable fishing communities.
- Designed and built a motorcycle-pulled transport cart using common parts to enable direct-to-market delivery, incorporating a novel roll-and-pitch joint to maintain cart stability during transport.
- I was then asked to return for a special summer session, travelling to Kenya and partnering with Factor[E] to identify a low-cost storage solution for rural potato farmers. Co-developed a low-cost drying and storage rack that could be assembled without power tools, using readily available materials.

Mechanical Engineering Design | Student Researcher Stanford University | Spring 2018

- Worked with a construction industry partner to design and fabricate a novel powder-based fused deposition system for large-scale additive manufacturing using casting wax. My contribution was the design and implementation of the mechatronic system, as well as software / hardware integration.

Perspectives in Assistive Technology | Student Researcher Stanford University | Winter 2016

- Our team developed a running aid for individuals with blindness and vision impairment, including extensive user testing and iterations. My role was to implement the mechatronic components, which included ultrasonic sensing and wireless vibrotactile feedback through wearable haptic wristbands.

Summer Undergraduate Research Institute | Researcher Stanford University | Summer 2016

- Developed Augmented Engineering, a proof-of-concept prototype that utilizes augmented-reality projections of engineering CAD / CAM models within a user's field of view coupled with language-agnostic visual cues and instructions to allow users to assemble / repair complex physical models.

NASA High Altitude Ballooning | Researcher City Colleges of Chicago | Spring – Fall 2015

- Developed an optical sensor payload using common LED modules to measure relative levels of sky glow caused by light pollution, which was flown during special night-time launches.
- Designed, built, and flew experimental payloads launched by high-altitude balloons to an altitude of approximately 30 kilometers under a NASA grant with the City Colleges of Chicago.

SUMMARY OF SKILLS

Technical & Systems Skills

- **Hardware & Fabrication:** Metalworking (machine lathe, manual mill, 3-axis CNC); rapid prototyping through SLA and filament-based 3D printing, laser cutting, and soft textiles.
- **Software & Programming:** C/C++, MATLAB, embedded firmware development (Teensy, Arduino-class platforms), marker-based vision tracking and pose estimation, sensor fusion.
- **Mechanical & System Design:** SOLIDWORKS, HSM Works; wearable haptic feedback system design, tendon-driven kinesthetic mechanisms, mechatronic system integration.

Research Skills

- **Human-Computer Interaction & Assistive Technology:** Haptic system design and evaluation, eyes-free guidance, inclusive research design for participants with visual impairments, wearable assistive devices.
- **Study Design & Methods:** User study design, user study design for blind / vision-impaired participants, inclusive research design.
- **Academic communications:** Publication to IEEE and ACM standards (journal and conference papers, posters), technical writing, science communication (Stanford Notation in Science Communication).

Design & Communication Skills

- **Graphic & Visual Design:** Adobe Creative Suite (Photoshop, Illustrator, Premiere), Autodesk 3D Studio.
- **Languages & Outreach:** Native fluency in English and Polish; community mentorship and STEM outreach, including cross-institutional and international collaboration.

PUBLICATIONS AND PRESENTATIONS

Under Review

- **Journal Paper:** Trzpit, T., Reardon, G., Shilati, A., Gerber, E., Peshkin, M., Colgate, J.E. (2026) NURing: Whole-Arm Guidance via Fingertip Deflection While Preserving Touch and Dexterity. *IEEE Transactions on Haptics*. Manuscript under review.

Peer-Reviewed Publications

- **Conference Paper:** Trzpit, T., Reardon, G., Shilati, A., Gerber, E., Peshkin, M., Colgate, J.E. (2025) NURing: A Tendon-Driven Wearable Ring for On-Demand Kinesthetic Haptic Feedback. *IEEE World Haptics Conference 2025*.
- **Conference Paper:** Meyer, J., Pinosky, A., Trzpit, T., Colgate, J.E., Murphey, T. (2022) A Game Benchmark for Real-Time Human-Swarm Control. *2022 IEEE 18th International Conference on Automation Science and Engineering (CASE)*.

Posters and Presentations

- **Interactive Demonstration:** Trzpit, T., Reardon, G., Gerber, E., Lopes, P., Peshkin, M., Colgate, J.E. (2026); Demonstrating Eyes-Free Object Retrieval via Fingertip Deflection Guidance Using the NURing. *ACM CHI 2026, Extended Abstracts*.
- **Conference Poster:** Trzpit, T., Reardon, G., Gerber, E., Lopes, P., Peshkin, M., Colgate, J.E. (2026); Camera-Based Closed-Loop Fingertip Deflection Guidance: Pilot Demonstrations in Target Acquisition and Object Retrieval. *ACM CHI 2026, Extended Abstracts*.
- **Conference Poster:** Trzpit, T., Peshkin, M., Colgate, J.E. (2023) A Device for Implementing Kinesthetic Fingertip Guidance and Constraint on Planar Surfaces. *IEEE World Haptics Conference 2023*.
- **Conference Poster:** Trzpit, T., Waldron, M., Waldron, K. (2017) Smart Robots in our Mix: Collaborating in High Tech Environments. *Academic Technology Expo (ATXpo) IdeaLab* (Stanford, CA).
- **Research Poster:** Trzpit, T., Waldron, M., Waldron, K. (2016) Augmented Engineering: Enhancing the Capabilities of the Workforce. *Stanford Undergraduate Research Institute Poster Session* (Stanford, CA).
- **Research Poster:** Trzpit, T., (2015) Assessing the Relative Amount of Sky Glow and Light Pollution using High-Altitude Ballooning. *CCC / NASA High Altitude Ballooning Fellowship* (Chicago, IL).

PATENTS

- T. Trzpit, J.E. Colgate, M. Peshkin. Wearable Kinesthetic Guidance Device with Integrated Sensing for Object-Referenced Fingertip Deflection. Invention Disclosure filed March 2026.

PROFESSIONAL EXPERIENCE

Robotics Engineer | EnExG - Laing O'Rourke (Sydney, Australia) June - September 2017

- I was part of a team that researched and developed wearable haptic-feedback devices to provide computer-vision based alerts to equipment operators within construction sites. The device is now commercially available (The Toolbox Spotter) and won the 2019 Australasian Rail Industry's Innovation and Technology Award.
- My contributions included implementing an encrypted wireless network utilizing the XBee protocol to coordinate between sensors, processing nodes, and feedback devices with an outdoor range of one kilometer. I also developed the wireless haptic feedback wristbands (AlertWear) used by the system.
- Responsible for circuit design, embedded device programming, and testing of the haptic and network elements *in situ* at the Royal Australian Air Force Base Amberley in Queensland, Australia.

Senior Graphics Specialist | M3 Capital Partners LLC (Chicago, Illinois) 2002 - 2013

- Prior to returning to school and pursuing an education in engineering, I was the head of graphic design and production for an international capital management firm, where I created digital and print media for multiple clients in multiple languages with an eye towards maintaining corporate standards and a strong attention to detail in a high-paced environment.

SERVICE AND OUTREACH

Co-President | Stanford Transfer Network, Stanford University 2016-2017

- I worked with the Vice Provost for Teaching and Learning to mentor to incoming transfer students.

President | Society of Hispanic Professional Engineers, City Colleges of Chicago 2013-2015

- I served as president of the Richard J. Daley College chapter representing the City Colleges of Chicago, during which time we grew membership in the organization from 9 students to over 40.
- Organized a student delegation for the Collegiate Leadership Development Program, which resulted in fifteen members earning scholarships to the 2015 United States Hispanic Leadership Institute Conference.
- Spearheaded the creation of a partnership with Sarah E. Goode STEM Academy (Chicago), in which members of our chapter would spend two hours a week mentoring high school students in STEM courses and activities, as well as tutoring dual-enrollment students.