Curt A Laubscher

http://curtlaubscher.com
https://orcid.org/0000-0003-3513-8184
https://codeberg.org/usercurt
laubscher.curt@gmail.com
+1 (440) 508 6534
Ann Arbor, MI, USA. Open to relocation

Career

Postdoctoral Researcher, University of Michigan, May 2022 – Present
Locomotor Control Systems Laboratory Mentor: Dr. Robert D. Gregg
Mentored students, designed phase-based prosthesis controllers 9 publications, 3 patent apps.

Postdoctoral Researcher, Cleveland State University, May 2020 – April 2022
Center for Rotating Machinery Dynamics and Control Mentor: Dr. Jerzy T. Sawicki
Research on novel controllers on Indego Explorer exoskeleton 6 publications

Graduate Assistant, Cleveland State University, July 2014 – May 2020
Center for Rotating Machinery Dynamics and Control Advisor: Dr. Jerzy T. Sawicki
PhD dissertation on design and control of a pediatric exoskeleton 7 publications, 2 patent apps.

Intern, Aclara RF Systems Inc. June 2012 – Aug 2012
Managed transfer and update of technical drawings, BOMs, etc. to new Teamcenter PLM software

Engineering Intern, Fredrick, Fredrick & Heller May 2011 – Aug 2011, Dec 2011 – Jan 2012
Collaborated with electrical/mechanical engineers to design HVAC/plumbing/piping in AutoCAD & Revit

Technical Skills

Experimental Research and Data Analysis

Human-Subject Research: Experimental protocol development and execution; Participant recruitment and coordination; Transfemoral amputee studies; Controller validation with participants; Familiarity with IRB protocols and informed consent

Signal Processing and Analysis: Motion-capture data analysis (e.g., kinematics, kinetics, segmentation); Digital filtering and outlier removal; Time-series synchronization; Frequency-domain analysis; Comparisons between conditions and statistics (e.g., t-tests, ANOVA, fixed-effects models)

Applied Control Methods

Control Methods: Impedance control; Phase-based control and hybrid zero dynamics; Feedback linearization and computed torque control; PID tracking; Reference trajectory generation; Custom developed strategies (e.g., hybrid impedance-sliding mode and angular-momentum-based control)

Control Logic and Flow: Finite-state machines and transition rules; Activity classification and intent recognition; Continuous interpolation between activity control modes

Modeling and Estimation

Modeling and System Identification: Physics-based and data-driven modeling (white/gray/black-box); Modeling of dynamical systems; Structure selection; Linear system and parameter identification

Estimation and Filtering: IIR and FIR filters; Complementary filtering for IMU sensor fusion; Extended Kalman filtering and state estimation; Phase (gait progression) estimation

Programming and Real-Time Environments

Coding: Expert in MATLAB; Proficient in Python, Simulink, LabVIEW; Prior exposure to C#, Pascal

Real-Time Environments: NI LabVIEW/myRIO; dSPACE MicroLabBox; Simulink Desktop Real-Time

Networking and Messaging: Custom application-layer protocols; ZeroMQ; Network topologies

Robotic Platforms and Mechanical Design

Platforms: Össur Power Knee; Parker Hannifin / Ekso Indego Explorer exoskeleton; In-house powered knee-ankle and powered-knee passive-ankle prostheses; Custom-designed lower-limb exoskeleton

Design: Lower-limb exoskeleton design; Joint actuator and transmission design; Biomechanical design requirements; Technical drawings; Dimensional tolerancing; Prototype assembly; Benchtop validation

CAD Software: Proficient in SolidWorks; Prior exposure to Autodesk Inventor

Education

Doctor of Philosophy in Engineering, Cleveland State University — May 2020
PhD dissertation on design and control of a pediatric exoskeleton — Advisor: Dr. Jerzy T. Sawicki
Specialized in system dynamics, control, mechatronics

Bachelor of Mechanical Engineering with physics minor, Cleveland State University — May 2014
Senior capstone on 7-person team developing hydraulic bicycle for national competition

Selected Publications

Patents

J. T. Sawicki, J. J. Wiebrecht, **C. A. Laubscher**, A. C. Goo, R. J. Farris, and S. J.-S. Etheridge, "Adjustability mechanism for lower limb orthosis," U.S. Patent No. 12,558,244, 2026.

R. D. Gregg, S. Cheng, **C. A. Laubscher**, "Powered prosthesis and activity classifier", International Patent App. No. PCT/US2025/053837, 2025.

R. D. Gregg, A. E. Lang, **C. A. Laubscher**, and S. Cheng, "Limb-assistive device and system with user-wearable interface", U.S. Patent App. No. 63/839,889, 2025.

R. D. Gregg, S. Cheng, **C. A. Laubscher**, "Powered lower limb assistive device with obstacle avoidance," International Patent App. No. PCT/US2024/057193, 2024.

J. T. Sawicki, **C. A. Laubscher**, R. J. Farris, and S. J.-S. Etheridge, "Actuating device for powered orthosis," U.S. Patent No. 11,207,234, 2021.

Journal Articles

E. G. Keller, **C. A. Laubscher**, and R. D. Gregg, "Effects of a powered knee-ankle prosthesis on intact joint biomechanics across sustained activities of daily life: A case series," *IEEE Transactions on Neural Systems & Rehabilitation Engineering*, 2026.

S. Cheng, **C. A. Laubscher**, T. K. Best, and R. D. Gregg, "Ambilateral activity recognition and continuous adaptation with a powered knee ankle prosthesis," *IEEE Transactions on Robotics*, 2025.

S. Cheng, **C. A. Laubscher**, and R. D. Gregg, "Controlling powered prosthesis kinematics over continuous inter-leg transitions between walking and stair ascent/descent," *IEEE Transactions on Neural Systems & Rehabilitation Engineering*, 2024.

A. C. Goo, **C. A. Laubscher**, D. A. Wajda, and J. T. Sawicki, "Preliminary virtual constraint-based control evaluation on a pediatric lower limb exoskeleton," *MDPI Bioengineering*, 2024.

S. Cheng, **C. A. Laubscher**, and R. D. Gregg, "Automatic stub avoidance for a powered prosthetic leg over stairs and obstacles," *IEEE Transactions on Biomedical Engineering*, 2024.

C. A. Laubscher, A. C. Goo, R. J. Farris, and J. T. Sawicki, "Optimal phase-based gait guidance control on a lower-limb exoskeleton," *Elsevier Control Engineering Practice*, 2023.

A. C. Goo, **C. A. Laubscher**, J. J. Wiebrecht, and J. T. Sawicki, "Hybrid zero dynamics control for gait guidance of a novel adjustable pediatric lower-limb exoskeleton," *MDPI Bioengineering*, 2022.

A. C. Goo, **C. A. Laubscher**, and J. T. Sawicki, "Hybrid zero dynamics control of an underactuated lower-limb exoskeleton for gait guidance," *ASME J. of Dynamic Systems, Measurement & Control*, 2022.

C. A. Laubscher, A. C. Goo, R. J. Farris, and J. T. Sawicki, "Hybrid impedance-sliding mode switching control of the Indego Explorer lower-limb exoskeleton in able-bodied walking," *Springer J. of Intelligent & Robotic Systems*, 2022.

C. A. Laubscher, R. J. Farris, A. J. van den Bogert, and J. T. Sawicki, "An anthropometrically parameterized assistive lower limb exoskeleton," *ASME J. of Biomechanical Engineering*, 2021.

C. A. Laubscher and J. T. Sawicki, "A robust impedance controller for improved safety in human-robot interaction," *ASME J. of Dynamic Systems, Measurement, & Control*, 2021.

A. C. Goo, **C. A. Laubscher**, R. J. Farris, and J. T. Sawicki, "Design and evaluation of a pediatric lower-limb exoskeleton joint actuator," *MDPI Actuators*, 2020.

C. A. Laubscher, R. J. Farris, and J. T. Sawicki, "Angular momentum-based control of an underactuated orthotic system for crouch-to-stand motion," *Springer Autonomous Robots*, 2020.

Conference Papers and Posters

A. E. Lang, **C. A. Laubscher**, S. Cheng, and R. D. Gregg, "Vibrotactile haptic and gesture feedback in a smartwatch for controlling a multi-activity powered knee-ankle prosthesis," in *Annual Int. Conf. of the IEEE Engineering in Medicine & Biology Society (EMBC)*, 2025.

A. J. Lee, **C. A. Laubscher**, T. K. Best, and R. D. Gregg, "Towards a unified approach for continuously variable impedance control of powered prosthetic legs over walking speeds and inclines," in *IEEE Int. Conf. on Robotics & Automation (ICRA)*, 2024.

T. K. Best, **C. A. Laubscher**, R. Cortino, S. Cheng, and R. D. Gregg, "Improving amputee endurance over activities of daily living with a robotic knee ankle prosthesis: A case study," in *IEEE/RSJ Int. Conf. on Intelligent Robots & Systems (IROS)*, 2023. **IROS Best Application Paper Award Finalist.**

S. Cheng, **C. A. Laubscher**, and R. D. Gregg, "Controlling powered prosthesis kinematics over continuous transitions between walk and stair ascent," in *IEEE/RSJ Int. Conf. on Intelligent Robots & Systems (IROS)*, 2023. **IROS Best Student Paper Award.**

E. Keller, **C. A. Laubscher**, and R. D. Gregg, "Gait event detection with proprioceptive force sensing in a powered knee ankle prosthesis: validation over walking speeds and slopes," in *IEEE Int. Conf. on*

Robotics & Automation (ICRA), 2023.

C. A. Laubscher and J. T. Sawicki, "Robust control-oriented modeling of a feedback-linearized powered pediatric lower-limb orthosis," in *ASME Int. Mechanical Engineering Congress & Exposition (IMECE)*, 2019.

C. A. Laubscher and J. T. Sawicki, "Gait guidance control for damping of unnatural motion in a powered pediatric lower-limb orthosis," in *IEEE Int. Conf. on Rehabilitation Robotics (ICORR)*, 2019.

D. J. Maher, A. A. Garnett, **C. A. Laubscher**, J. T. Sawicki, and D. J. Simon, "Extended Kalman filter-based control of a pediatric exoskeleton," in *ASME Int. Mechanical Engineering Congress & Exposition (IMECE)*, 2017.

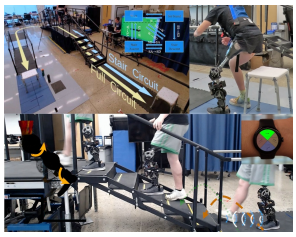
C. A. Laubscher, R. J. Farris, and J. T. Sawicki, "Design and preliminary evaluation of a powered pediatric lower limb orthosis," in *ASME Int. Design Engineering Technical Conferences & Computers and Information in Engineering Conf. (IDETC)*, 2017.

Dissertation

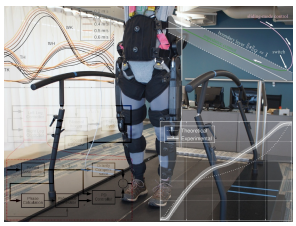
C. A. Laubscher, "Design and development of a powered pediatric lower-limb orthosis", PhD Dissertation, Cleveland State University, Cleveland, OH, US, 2020.

Selected Projects

Össur Power Knee control, University of Michigan 2026 – Present
Actively working with the Össur Power Knee as a postdoctoral researcher at the Locomotor Control Systems Lab. I am mentoring a student on adapting the lab's data-driven impedance controller to commercial hardware for incline and decline walking. My involvement is experimental testing and discussing controller changes for accommodating the device's passive ankle. Video



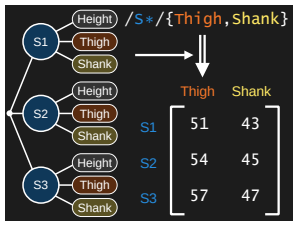
Powered prosthesis control, University of Michigan 2022 – Present
Mentored several students as a postdoctoral researcher and contributed to their research in phase-based impedance controllers for powered prostheses, including experimental evaluation with recruited transfemoral amputee participants. I also led the design and execution of an endurance study evaluating classifier performance and biomechanical outcomes. Videos: Classifier, Stair transitions, Avoiding stubs, Endurance, More stair transitions



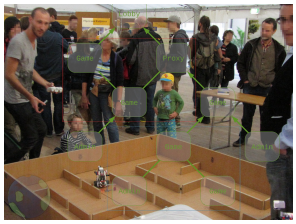
Indego exoskeleton control, Cleveland State University 2020 – 2022
Developed and experimentally evaluated novel control strategies on the Indego Explorer exoskeleton, formerly developed by Parker Hannifin and now Ekso Bionics. As a postdoctoral researcher at Cleveland State University, I designed a hybrid impedance-sliding mode controller and a hybrid zero dynamics controller with optimal definition for the phase variable. Video

Pediatric exoskeleton, PhD research and thesis 2014 – 2020
Designed and prototyped an anthropometrics-based 3D-printed exoskeleton using a methodology intended to adapt for growing children with cerebral palsy. The custom-developed actuator was characterized and experimentally tested using provisional hardware and an adult prototype for feasibility. This work was in collaboration with Parker Hannifin. Video 1, Video 2

Prosthesis control dashboard, University of Michigan 2025 – Present
A GUI made in PySide6 for real-time monitoring and controlling of a powered prosthesis, showing live sensor data and sending user inputs using custom Qt widgets. The backend is a shared variable framework using ZeroMQ for bi-directional data communication across multiple devices, allowing flexibility and ease-of-use for future users. Developed with agentic tools under my direction.



MPath field access, Personal technical project 2025 – Present
A tool for navigating and modifying deeply nested data structures in MATLAB using concise string expressions. It replaces loops and temporary variables when working with hierarchical data, reducing the amount of code dedicated to data-wrangling. The open-source code is on Codeberg and is developed with agent-assisted coding under close manual review and direction.



Networking protocol, Personal technical project 2008 – 2015
Developed a machine-to-machine networking protocol and API as part of an international team. It featured a hybrid tree and peer-to-peer topology with general message routing protocol and resilient topology state propagation. A remote-control example was demonstrated using LEGO Mindstorms EV3 robots at the 2014 City Campus exhibition in Trier, Germany. Video

Professional Activities and Recognitions

Recognitions and Awards

Received the Graduate Student Research Award (GSRA) from Cleveland State University which provided partial support my PhD research (2019).

Placed 3rd in Research Day poster competition at Washkewicz College of Engineering, Cleveland State University (2018).

Student member of Tau Beta Pi Engineering Honor Society (2012 – Present), CSU NSF/STEM Program (2010 – 2013), and Scholars Program (2009 – 2013).

Placed 1st in Technical Drafting SkillsUSA regional competition (2009) and 1st in Related Technical Math SkillsUSA state competition (2008).

Mentorship Experience

Mentored several PhD students at the University of Michigan in control development, theoretical analysis, hardware integration, debugging, experimental design, participant interaction, data analysis, manuscript preparation, and fellowship proposals. This hands-on involvement contributed to my co-authorship on 9 publications and 3 patent applications.

Mentored several undergraduate and master's students at the University of Michigan through Summer Undergraduate Research in Engineering (SURE), Undergraduate Research Opportunity Program (UROP), Directed Study MS credits, or volunteers. I provided mentorship in control development, theoretical analysis, hardware integration, debugging, research practice, and data analysis.

Mentored 2 students from the Research Experiences for Undergraduates (REU) program at Cleveland State University in performing simulations and experiments with the pediatric exoskeleton, resulting in 1 publication (2017).