

# James R. Hermus

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| CONTACT INFORMATION | EPFL STI IMT LASA, Station 9<br>ME A3 464<br>1015 Lausanne, Switzerland   | Cell: +1(608) 444-2779<br>E-mail: jameshermus@gmail.com<br>Website: jameshermus.github.io |
| RESEARCH INTERESTS  | Robotic Manipulation, Physical Interaction, Kinematic Redundancy, and System Identification.  |   |
| EDUCATION           | <b>Massachusetts Institute of Technology</b> , Cambridge, Massachusetts<br>Ph.D., Mechanical Engineering <b>September 2022</b> <ul style="list-style-type: none"><li>• Fellowship in Graduate Coaching</li><li>• Kaufman Teaching Certificate</li><li>• Course work: Controls, Dynamics, System ID, Machine Learning, Robotic Manipulation</li></ul> <b>Massachusetts Institute of Technology</b> , Cambridge, Massachusetts<br>S.M., Mechanical Engineering <b>June 2018</b><br><b>University of Wisconsin-Madison</b> , Madison, Wisconsin<br>B.S., Biomedical Engineering <b>May 2016</b> <ul style="list-style-type: none"><li>• Honors in Research</li><li>• Biology in Engineering Certificate</li></ul>  |   |
| RESEARCH EXPERIENCE | <b>Postdoctoral Researcher</b> <b>February 2023 - Present</b><br>The Learning Algorithms and Systems (LASA) Laboratory<br>École Polytechnique Fédérale de Lausanne (EPFL)<br>Lab Director: Professor Aude Billard<br>Research Topics: Robotic Dual Arm Manipulation, and Robotic Dexterous Throwing <ul style="list-style-type: none"><li>• Led a team comprised of a postdoc, two graduate students, and 2-4 engineers.</li><li>• Conducted preliminary reinforcement learning experiments for manipulation.</li><li>• Led EPFL portion of the Impact Aware Manipulation (I.A.M.) European consortium focused on dual arm box grasping and hitting with the Franka Emika Panda and Kuka LBR iiwa.</li><li>• Managed the EPFL portion of the Dynamics Agile Robotics (DARKO) European consortium focused on the development of autonomous throwing research with the Franka Emika Panda.</li><li>• Collaborated with people from other universities across the EU e.g. TUM, CNRS, UNIPI, TU/e.</li><li>• Additional: Organized workshops, advised master projects, and conducted hiring interviews.</li></ul><br><b>Postdoctoral Researcher</b> <b>September 2022 - January 2023</b><br><b>Graduate Research Assistant</b> <b>October 2016 - September 2022</b><br>The Eric P. and Evelyn E. Newman Laboratory for Biomechanics and Human Rehabilitation<br>Massachusetts Institute of Technology<br>Lab Director: Professor Neville Hogan<br>Research Topics: Motor Neuroscience, Physical Interaction, Kinematically Redundant Robotics <ul style="list-style-type: none"><li>• Implemented torque controllers on robotics systems: InMotion, LBR iiwa, WAM, and Baxter.</li><li>• Developed novel system ID methods to estimate the mechanical impedance of the human arm.</li><li>• Designed and collected human subject tests while interacting with the InMotion robot.</li><li>• Performed multivariate statistical analysis on human subject experimental data.</li><li>• Mentored undergraduate student research assistants.</li><li>• Worked with neuroscientists to search for neural correlates of impedance in motor cortex activity.</li><li>• Collaborated with: Kuka, the University of Pittsburgh, and Northeastern University.</li><li>• Developed a novel force-dependent coupling for human exoskeletons; US patent.</li></ul><br><b>Undergraduate Research Assistant</b> <b>May 2015 - August 2016</b><br>Neuromuscular Biomechanics Lab, University of Wisconsin-Madison<br>Lab Director: Professor Darryl Thelen<br>Research Topics: Biomechanics, Tendon Stress Estimation, Mechanical Design, MRI Imaging <ul style="list-style-type: none"><li>• Estimated tendon stress with ultrasound imaging, accelerometers, and piezo actuators.</li><li>• Designed and 3D printed components for tendon stress estimation and dynamic MRI.</li></ul> |   |

**Undergraduate Research Assistant** **May 2013-May 2015**  
 Department of Medical Physics, University of Wisconsin-Madison  
 Lab Director: Professor Charles Mistretta and Professor Timothy P. Szczykutowicz  
 Research Topics: Computed Tomography, Digital Subtraction Angiography, Beam Attenuators

- Designed metal artifact and beam hardening correction algorithms for CT angiography.
- Programmed, designed, and evaluated prototypes for 2D x-ray attenuating filters.

TEACHING EXPERIENCE **Lecturer (50% time)** **Fall Term 2022**  
 Course 2.151: Advances System Dynamics and Control  
 Rating: 6.5/7  
 Massachusetts Institute of Technology

**Kaufman Teaching Certificate Program** **Fall Term 2022**  
 During the completion of the KTCP course offered by the Teaching + Learning Lab at MIT, we covered several important topics including course design, teaching for belonging, outlining a unit of a course, engaging students and facilitating learning, planning for learning, microteaching, feedback and learning, and syllabus construction.

TECHNICAL SKILLS **Programming:** Matlab, Python, LabVIEW, Java, Arduino, C++, UNIX shell scripting  
**Applications:** DRAKE, GitHub, Solidworks, ROS, SPSS, Geomagic, Mimics, Meshlab, L<sup>A</sup>T<sub>E</sub>X, Adobe Illustrator, Imagej, Kurzweil, Microsoft Office  
**Robot Experience:** Kuka LBR iiwa, Franka Emika Panda, Barrett WAM, Rethink Robotics Baxter, InMotion2, HapticMaster  
**Mechanical:** 3D printing (Stratasys - Dimensional Elite, Zortrax - M200, MarkForged, Sindoh - 3DWOX DP200), lathe, mill, MIG/TIG/SMAW/gas welder, mechanical testing (Instron), laser cutter, CNC router, drill press, table saw, band saw

AWARDS **Institute of Electrical and Electronics Engineers (IEEE)**  
 Travel grant for IROS to Workshop - Member Support Program **2023**  
**Massachusetts Institute of Technology**  
 de Florez Graduate Science Competition - 2nd Place **2022**  
 SNAME Travel Award in Ocean Engineering by MIT MechE **2022**  
 Mechanical Engineering Research Exhibition - 1st Place **2021**  
 Mechanical Engineering Research Exhibition - Honorable Mention **2019**  
 Mechanical Engineering Research Exhibition - Runner up **2018**  
 Harrington Fellowship **2016**  
 2.120 - Introduction to Robotics Competition **2016**  
 Most Valuable Engineering  
 Best Navigation  
 Collier Adventure Grant **2018**  
**University of Wisconsin-Madison**  
 Steuber Prize for Excellence in First-Year Writing **2013**  
 Hilldale Undergraduate/Faculty Research Fellowship **2014**  
 University Book Store Academic Excellence Award **2014**  
 Fred W. & Josephine Colbeck Scholarship **2014, 2015**  
 Wisconsin Experience Accessibility Scholarship **2015**  
 Dallas R. Lamont Scholarship **2013, 2014, 2015**  
 Dean's List **2012-15**  
**Boy Scouts Of America - Eagle Scout** **2010**

INTELLECTUAL PROPERTY Meghan Huber, **James Hermus**, Gabrielle Enns, and Neville Hogan (2020). Variable Compression Body Anchor. Patent Number US 11,690,776 B2. Date of Patent July 4, 2023.

PEER REVIEWED PUBLICATIONS Federico Tessari, **James Hermus**, Rika Sugimoto-Dimitrova, and Neville Hogan. Brownian Processes in Human Motor Control Support Descending Neural Velocity Commands. *Scientific Reports – Nature* **14(8341)** 2024 [Link]

PEER REVIEWED PUBLICATIONS (CONTINUED) Chenguang Zhang, Federico Tessari, **James Hermus**, Himanshu Akolkar, Neville Hogan, Andrew B. Schwartz. Tuning of Task-Relevant Stiffness in Multiple Directions. *Science Robotics* 2023 (Submitted)

**James Hermus**, Joseph Doeringer, Dagmar Sternad, and Neville Hogan. Dynamic Primitives in Constrained Action: Systematic Changes in the Zero-Force Trajectory. *Journal of Neurophysiology* **131(1)** 2024 [Link]

A. Michael West Jr., **James Hermus**, Meghan Huber, Pauline Maurice, Dagmar Sternad, and Neville Hogan. Dynamic Primitives Limit Human Force Regulation during Motion. *IEEE Robotics and Automation Letters* **7(2)** 2022 [Link]

**James Hermus**, Johannes Lachner, David Verdi, and Neville Hogan. Exploiting Redundancy to Facilitate Physical Interaction. *IEEE Transactions on Robotics* **38(1)** 2021 [Link]

**James Hermus**, Joseph Doeringer, Dagmar Sternad, and Neville Hogan. Separating Neural Influences from Peripheral Mechanics: The Speed-Curvature Relation in Mechanically-Constrained Actions. *Journal of Neurophysiology* **123(5)** 2020 [Link]

Jack A. Martin, Scott C.E. Brandon, Emily M. Keuler, **James R. Hermus**, Alexander C. Ehlers, Daniel J. Segalman, Matthew S. Allen, and Darryl G. Thelen. Gauging Force by Tapping Tendons. *Nature Communications* **9(1)** 2018 [Link]

**James Hermus** and Timothy P. Szczykutowicz. 2D-Dynamic Fluid Bowtie Attenuators. *Journal of Medical Imaging (JMI)* **3(1)** 2016 [Link]

Timothy P. Szczykutowicz, **James Hermus**, Mark Geurts, and Jeniffer Smilowitz. Realization of Fluence Field Modulated CT on a Clinical TomoTherapy Megavoltage CT System. *Physics in Medicine and Biology* **60(18)** 2015 [Link]

Timothy P. Szczykutowicz and **James Hermus**. Creation of An Atlas of Filter Positions for Fluence Field Modulated CT. *Medical Physics* **42(4)** 2015 [Link]

CONFERENCE PUBLICATIONS **James Hermus**, Dagmar Sternad, Neville Hogan. (2020, November). Evidence for Dynamic Primitives in a Constrained Motion Task. *8th IEEE International Conference on Biomedical Robotics and Biomechanics (BioRob)*, New York, NY. [Link]

Timothy P. Szczykutowicz, **James Hermus**, Mark Geurts, and Jeniffer Smilowitz. (2015, June). Intensity Modulated Imaging?: Clinical Workflow for Fluence Field Modulated CT On a TomoTherapy System. Presented at the *2015 Annual Medical Physics meeting of the American association of physicists in medicine Summer Meeting*. TH-EF-BRB-6 [Link]

Timothy P. Szczykutowicz and **James Hermus**. (2015, March). Fluence Field Modulated CT on a Clinical TomoTherapy Radiation Therapy Machine. Oral presentation at the *2015 Annual SPIE Medical Imaging Conference*, Proc. 9412, Orlando, FL. [Link]

**James Hermus**, Charles A. Mistretta and Timothy P. Szczykutowicz. (2015, March). Scatter Correction of Vessel Dropout Behind Highly Attenuating Structures in 4D-DSA. Poster presentation at the *2015 Annual SPIE Medical Imaging Conference*, Proc. 9412, Orlando, FL. [Link]

Timothy P. Szczykutowicz and **James Hermus**. Fluid Dynamic Bowtie Attenuators. (2015, March). Oral presentation (**I presented the talk**) at the *2015 Annual SPIE Medical Imaging Conference*, Proc. 9412-31, Orlando, FL. [Link]

**James Hermus**, Cameron Hays, Michal Adamski, Hannah Lider, Jenny Westlund, Austin Scholp, John Webster and Bjoern Buehring. (2015, May). Posture Monitor for Vibration Exercise Training. Oral presentation at the *2015 IEEE Great Lakes Biomedical Conference*, Milwaukee, WI. [Link]

CONFERENCE  
PUBLICATIONS  
(CONTINUED)

**James Hermus**, Timothy P. Szczykutowicz, Brian Davis, Erick L. Oberstar, Martin Wagner, Charles M. Strother, and Charles Mistretta. (2014, March). Quantitative Analysis of Artifacts in 4D DSA: the Relative Contributions of Beam Hardening and Scatter to Vessel Dropout Behind Highly Attenuating Structures. Poster presented at *the 2014 Annual SPIE Medical Imaging Conference*, Proc. 9033, San Diego, CA. [\[Link\]](#)

CONFERENCE PRESENTATIONS **James Hermus**, Federico Tessari, Rika Sugimoto-Dimitrova, Neville Hogan. (2023, November). Velocity-level Planning in Human Neuro-motor Control: Behavioral Evidence Based on Brownian Processes. Poster presented at the 2023 *Annual Conference of the Society for Neuroscience*, Abstract no. 5698, Washington, D.C.

Federico Tessari, Chenguang Zhang, Himanshu Akolkar, **James Hermus**, Neville Hogan, Andrew Schwartz. (2023, November). Direction-independent Stiffness Regulation in a Challenging Ballistic Release Tasks Highlights Human Neuro-Motor Performance Limitations. Poster presented at the 2023 *Annual Conference of the Society for Neuroscience*, Abstract no. 5627, Washington, D.C.

Chenguang Zhang, Himanshu Akolkar, Federico Tessari, **James Hermus**, Neville Hogan, Andrew Schwartz. (2023, November). Direction-independent Impedance in Non-human Primates. Poster presented at the 2023 *Annual Conference of the Society for Neuroscience*, Abstract no. 5711, Washington, D.C.

Himanshu Akolkar, Chenguang Zhang, Federico Tessari, **James Hermus**, Neville Hogan, Andrew Schwartz. (2023, November). Task-dependent Stiffness is independent of Movement Direction and Muscle Activation. Poster presented at the 2023 *Annual Conference of the Society for Neuroscience*, Abstract no. 5016, Washington, D.C.

Chenguang Zhang, Himanshu Akolkar, Federico Tessari, **James Hermus**, Neville Hogan, Andrew Schwartz. (2022, December). Arm Impedance in Different Movement Directions. Poster presented at the 2023 *Annual Conference of the Society for Neuroscience*, Abstract no. 473.09, San Diego, CA.

**James Hermus**, Johannes Lachner, David Verdi, and Neville Hogan. (2022, May) Exploiting Redundancy to Facilitate Physical Interaction. Talk and poster at the 2022 *IEEE International Conference for Robotics and Automation*, Philadelphia, PA.

Michael West, Meghan Huber, **James Hermus**, Pauline Maurice, Dagmar Sternad, and Neville Hogan. (2021, April). Humans Do Not Directly Control Force During Motion. Poster at the 2021 *Annual Conference of the Society for the Neural Control of Movement*, Online.

**James Hermus**, Dagmar Sternad, and Neville Hogan. (2020, October). Features of Free Motion Persist in Constrained Actions. Poster at the 2021 *IEEE International Conference on Intelligent Robots and Systems, Workshop on Learning Impedance Modulation for Physical Interaction*, Online.

Laura Schwendeman, **James Hermus**, Neville Hogan. (2020, October). A Frame-Based Approach to Submovement Decomposition. Interactive talk at the 2020 *Neruomatch Conference*, Online. [\[Link\]](#)

**James Hermus**, Dagmar Sternad, Neville Hogan. (2019, October). Dynamic Primitives Account for Human Constrained Motion. Poster presented at the 2019 *Annual Conference of the Society for Neuroscience*, Chicago, IL.

**James Hermus**, Dagmar Sternad, Neville Hogan. (2019, May). Features of Free Motion Persist in Constrained Actions. Poster presented at the 2019 *Annual IEEE International Conference on Robotics and Automation: Human movement science for physical human-robot collaboration workshop*, Montreal, Canada.

**James Hermus**, Joseph Doeringer, Dagmar Sternad, Neville Hogan. (2018, July). Physical Interaction with a Circular Constraint. Oral presentation presented at the 2018 *Annual International Society of Electrophysiology and Kinesiology*. Session Motor Control II, Dublin, Ireland.

CONFERENCE PRESENTATIONS (CONTINUED) Jack A. Martin, Emily M. Keuler, **James R. Hermus**, Scott C.E. Brandon, Matthew S. Allen and Darryl G. Thelen. (2017, August). Achilles Tendon Wave Speed Tracks Joint Torque and Muscle Activity in Gait. **Received Best Oral Presentation Award** at the *2017 Annual American Society for Biomechanics Conference*, Boulder, CO.

Jack A. Martin, Alexander C. Ehlers, **James R. Hermus**, Matthew S. Allen, Daniel J. Segalman and Darryl G. Thelen. (2017, February). Dynamic Imaging of Tendon Tissue Stress. **Received 3rd place award** for the conference paper. Oral presentation at the *2017 Bi-annual Summer Biomechanics, Bioengineering and Biotransport Conference*, Tucson, AZ.

Jack A. Martin, Emily M. Keuler, **James R. Hermus**, Mikel R. Stiffler, Matthew S. Allen, and Darryl G. Thelen. (2016, August). Ultrasonic Imaging of In Vivo Achilles Tendon Stress During Walking. Presented at the *2016 Annual American Society for Biomechanics Conference*, Raleigh, NC.

INVITED TALKS Robotic Manipulation from a Human Motor Control Perspective. (2024, January). Spotlight talk at the *IEEE Robotics and Automation Society Robotics Workshop* at EPFL, Lausanne, Switzerland.

Real Time Adaptive Systems for Human-Robot Collaboration. (2023, March). Invited speaker at the Industry 4.0 Workshop at *Swiss Robotics Innovation Booster*, Bern, Switzerland.

Quantifying Strengths and Weaknesses of Human Motor Control and Perception. (2022, May). Invited speaker at the *Workshop - Intelligent Control Methods and Machine Learning Algorithms for Human-Robot Interaction and Assistive Robotics* as part of the 2022 *IEEE International Conference for Robotics and Automation*, Philadelphia, PA.

Human Physical Interaction with a Circular Constraint. (October, 2019). Invited speaker at the *UW-Madison Neuromuscular Biomechanics Lab*, Madison, WI.

UNIVERSITY SERVICE **Graduate Coach Fellow, MIT** **2020-2022**

- Trained as peer/group-coach facilitator to lead discussions
- Program based on International Coaching Federation standards and met weekly
- Led group coaching sessions to empower the professional/personal development of grad students
- Learned and practiced valuable team leadership/mentoring skills through a Coach Approach

**Makerworkshop, MIT** **2017-Present**

- 3D printing Machine Master
- Maintained Markforged, Stratasys, and Zortrax 3d printers for student use.
- Trained students on 3D printing and consulted on research and personal design projects.

**MIT Outing Club, MIT** **2017-Present**

- Treasurer, climbing leader, winter school leader
- Led climbing trips, taught technical rope skills, and shared a love for the outdoors.
- Managed club financials for the club (over \$100k)

ROBOTICS COMMUNITY SERVICE **Workshop Organizer**

- *IEEE Robotics and Automation Society Robotics Workshop at EPFL*. Lausanne, Switzerland. January 10, 2024.
- *Multilimb Coordination and Learning: an Interplay of Robotics and Human Neuroscience*. IEEE International Conference on Intelligent Robots and Systems (IROS). Detroit, MI. October 5, 2023. [\[Link\]](#)

**Reviewer**

- Scientific Reports – Nature
- IEEE Transactions of Robotics (T-RO)
- IEEE Robotics and Automation – Letters
- IEEE International Conference for Robotics and Automation (ICRA)
- IEEE International Conference on Intelligent Robots and Systems (ROS)
- Hindawi Applied Bionics and Biomechanics

SUPERVISION  
EXPERIENCE

**Masters Semester Project Mentees**

**Julien Mollard**

Department of Microengineering, EPFL

**Fall Semester 2023**

**Nathan Benavides**

Department of Microengineering, EPFL

**Fall Semester 2023**

**Adré Schakkal**

Department of Microengineering, EPFL

**Spring Semester 2023**

**Undergraduate Mentees**

**Jason Salmon**

Department of Mechanical Engineering, MIT

**June 2021 - June 2022**

**Laura Schwendeman**

Department of Mechanical Engineering, MIT

- Presented an interactive talk at Neuromatch 2020
- John C. and Elizabeth J. Chato Award for Excellence in Bioengineering

**December 2019 - May 2021**

**Christina Patterson**

Department of Mechanical Engineering, MIT

**December 2019 - February 2020**

**Gabrielle Enns**

Department of Mechanical Engineering, MIT

- Prince Innovation Award 2020 – awarded to an undergraduate with a patent/pending patent
- Prince Innovation Award 2021

**January 2019 - January 2020**

**Haley Higginbotham**

Department of Biological Engineering, MIT

**August 2018 - May 2019**

**Zelin Gong**

Department of Computer Engineering, Southern University of Science and Technology

**August 2019 - December 2019**

**Michael West Ph.D.**

Department of Mechanical Engineering, Yale University

- A highlight of the MIT Summer Research Program (MSRP) [[Video Link](#)]
- He later became a graduate student in MechE at MIT and a member of the Newman Lab.
- This work was published in IEEE RA-L

**May 2017 - August 2017**

**High School Mentees**

**Will Carter**

**July 2019**

IN THE PRESS “Learning challenges shape a mechanical engineer’s path.” MIT News. February 12th, 2023. [[Link](#)]

“Medical Meets Mechanical.” MechEConnects. Winter 2018, Department Newsletter. [[Link](#)]

“McBurney Disability Resource Center.” Forward Motion. Big Ten Network. June 12th, 2015 Television. [[Link](#)]