

James R. Hermus

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RESEARCH Robotic Manipulation, Physical Interaction, Kinematic Redundancy, and System Identification.
INTERESTS

EDUCATION **Massachusetts Institute of Technology**, Cambridge, Massachusetts
Ph.D., *Mechanical Engineering* **September 2022**

- *Fellowship in Graduate Coaching*
- *Kaufman Teaching Certificate*
- Course work: Controls, Dynamics, System ID, Machine Learning, Robotic Manipulation

Massachusetts Institute of Technology, Cambridge, Massachusetts
S.M., *Mechanical Engineering* **June 2018**
University of Wisconsin-Madison, Madison, Wisconsin
B.S., *Biomedical Engineering* **May 2016**

- *Honors in Research*
- *Biology in Engineering Certificate*

RESEARCH **Postdoctoral Researcher** **February 2023 - May 2024**
EXPERIENCE **The Learning Algorithms and Systems (LASA) Laboratory**
École Polytechnique Fédérale de Lausanne (EPFL)
Lab Director: Professor Aude Billard
Research Topics: Robotic Dual Arm Manipulation, and Robotic Dexterous Throwing

- Led a team comprised of a postdoc, two graduate students, and 2-4 engineers.
- Conducted preliminary reinforcement learning experiments for manipulation.
- 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.
- 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.
- Collaborated with people from other universities across the EU e.g. TUM, CNRS, UNIPI, TU/e.
- Additional: Organized workshops, advised master projects, and conducted hiring interviews.

Postdoctoral Researcher **September 2022 - January 2023**
Graduate Research Assistant **October 2016 - September 2022**
The Eric P. and Evelyn E. Newman Laboratory for Biomechanics and Human Rehabilitation
Massachusetts Institute of Technology
Lab Director: Professor Neville Hogan
Research Topics: Motor Neuroscience, Physical Interaction, Kinematically Redundant Robotics

- Implemented torque controllers on robotics systems: InMotion, LBR iiwa, WAM, and Baxter.
- Developed novel system ID methods to estimate the mechanical impedance of the human arm.
- Designed and collected human subject tests while interacting with the InMotion robot.
- Performed multivariate statistical analysis on human subject experimental data.
- Mentored undergraduate student research assistants.
- Worked with neuroscientists to search for neural correlates of impedance in motor cortex activity.
- Collaborated with: Kuka, the University of Pittsburgh, and Northeastern University.
- Developed a novel force-dependent coupling for human exoskeletons; US patent.

Undergraduate Research Assistant **May 2015 - August 2016**
Neuromuscular Biomechanics Lab, University of Wisconsin-Madison
Lab Director: Professor Darryl Thelen
Research Topics: Biomechanics, Tendon Stress Estimation, Mechanical Design, MRI Imaging

- Estimated tendon stress with ultrasound imaging, accelerometers, and piezo actuators.
- Designed and 3D printed components for tendon stress estimation and dynamic MRI.

PEER REVIEWED PUBLICATIONS (CONTINUED)	Chenguang Zhang, Federico Tessari, James Hermus , Himanshu Akolkar, Neville Hogan, Andrew Schwartz. Tuning of Task Relevant Stiffness in Multiple Directions. <i>Science Robotics</i> 2024 (Under review)
	Federico Tessari, James Hermus , Rika Sugimoto-Dimitrova, and Neville Hogan. Brownian Processes in Human Motor Control Support Descending Neural Velocity Commands. <i>Scientific Reports – Nature</i> 14(8341) 2024 [Link]
	James Hermus , Joseph Doeringer, Dagmar Sternad, and Neville Hogan. Dynamic Primitives in Constrained Action: Systematic Changes in the Zero-Force Trajectory. <i>Journal of Neurophysiology</i> 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. <i>IEEE Robotics and Automation Letters</i> 7(2) 2022 [Link]
	James Hermus , Johannes Lachner, David Verdi, and Neville Hogan. Exploiting Redundancy to Facilitate Physical Interaction. <i>IEEE Transactions on Robotics</i> 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. <i>Journal of Neurophysiology</i> 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. <i>Nature Communications</i> 9(1) 2018 [Link]
	James Hermus and Timothy P. Szczykutowicz. 2D-Dynamic Fluid Bowtie Attenuators. <i>Journal of Medical Imaging (JMI)</i> 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. <i>Physics in Medicine and Biology</i> 60(18) 2015 [Link]
	Timothy P. Szczykutowicz and James Hermus . Creation of An Atlas of Filter Positions for Fluence Field Modulated CT. <i>Medical Physics</i> 42(4) 2015 [Link]
CONFERENCE PUBLICATIONS	James Hermus , Dagmar Sternad, Neville Hogan. (2020, November). Evidence for Dynamic Primitives in a Constrained Motion Task. <i>8th IEEE International Conference on Biomedical Robotics and Biomechatronics (BioRob)</i> , 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 <i>2015 Annual Medical Physics meeting of the American association of physicists in medicine Summer Meeting</i> . 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 <i>2015 Annual SPIE Medical Imaging Conference</i> , 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 <i>2015 Annual SPIE Medical Imaging Conference</i> , 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 <i>2015 Annual SPIE Medical Imaging Conference</i> , 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 <i>2015 IEEE Great Lakes Biomedical Conference</i> , Milwaukee, WI. [Link]

- CONFERENCE PUBLICATIONS (CONTINUED) **James Hermus**, Timothy P. Szczukutowicz, 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)	<p>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 <i>2017 Annual American Society for Biomechanics Conference</i>, Boulder, CO.</p> <p>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 <i>2017 Bi-annual Summer Biomechanics, Bioengineering and Biotransport Conference</i>, Tucson, AZ.</p> <p>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 <i>2016 Annual American Society for Biomechanics Conference</i>, Raleigh, NC.</p>
INVITED TALKS	<p>Robotic Manipulation from a Human Motor Control Perspective. (2024, January). Spotlight talk at the <i>IEEE Robotics and Automation Society Robotics Workshop</i> at EPFL, Lausanne, Switzerland.</p> <p>Real Time Adaptive Systems for Human-Robot Collaboration. (2023, March). Invited speaker at the Industry 4.0 Workshop at <i>Swiss Robotics Innovation Booster</i>, Bern, Switzerland.</p> <p>Quantifying Strengths and Weaknesses of Human Motor Control and Perception. (2022, May). Invited speaker at the <i>Workshop - Intelligent Control Methods and Machine Learning Algorithms for Human-Robot Interaction and Assistive Robotics</i> as part of the 2022 <i>IEEE International Conference for Robotics and Automation</i>, Philadelphia, PA.</p> <p>Human Physical Interaction with a Circular Constraint. (October, 2019). Invited speaker at the <i>UW-Madison Neuromuscular Biomechanics Lab</i>, Madison, WI.</p>
UNIVERSITY SERVICE	<p>Graduate Coach Fellow, MIT 2020-2022</p> <ul style="list-style-type: none"> • 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 <p>Makerworkshop, MIT 2017-2023</p> <ul style="list-style-type: none"> • 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. <p>MIT Outing Club, MIT 2017-2023</p> <ul style="list-style-type: none"> • 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	<p>Workshop Organizer</p> <ul style="list-style-type: none"> • <i>IEEE Robotics and Automation Society Robotics Workshop at EPFL</i>. Lausanne, Switzerland. January 10, 2024. • <i>Multilimb Coordination and Learning: an Interplay of Robotics and Human Neuroscience</i>. IEEE International Conference on Intelligent Robots and Systems (IROS). Detroit, MI. October 5, 2023. [Link] <p>Reviewer</p> <ul style="list-style-type: none"> • 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	Doctoral Mentees	
	Harshit Khurana Department of Microengineering, EPFL	February 2023 - May 2024
	Yang Liu Department of Microengineering, EPFL	February 2023 - May 2024
	Masters Thesis Mentees	
	Nicolas Arons Department of Mechanical Engineering, MIT	September 2020 - September 2022
	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	December 2019 - May 2021
	<ul style="list-style-type: none"> • Presented an interactive talk at Neuromatch 2020 • John C. and Elizabeth J. Chato Award for Excellence in Bioengineering 	
	Christina Patterson Department of Mechanical Engineering, MIT	December 2019 - February 2020
	Gabrielle Enns Department of Mechanical Engineering, MIT	January 2019 - January 2020
	<ul style="list-style-type: none"> • Prince Innovation Award 2020 – awarded to an undergraduate with a patent/pending patent • Prince Innovation Award 2021 	
	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	May 2017 - August 2017
	<ul style="list-style-type: none"> • 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 	
	High School Mentees	
	Will Carter	July 2019
IN THE PRESS	<p>“Learning challenges shape a mechanical engineer’s path.” MIT News. February 12th, 2023. [Link]</p> <p>“Medical Meets Mechanical.” MechEConnects. Winter 2018, Department Newsletter. [Link]</p> <p>“McBurney Disability Resource Center.” Forward Motion. Big Ten Network. June 12th, 2015 Television. [Link]</p>	