

TONY SHU

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EDUCATION

<i>Doctor of Philosophy</i>	<i>2019-2024</i>	Massachusetts Institute of Technology Biomechatronics Group, K. Lisa Yang Center for Bionics Thesis: <i>A bone-anchored mechanoneural knee prosthesis to enhance control and embodiment</i> Committee: Hugh Herr, PhD · Rickard Brånemark, PhD · Nidhi Seethapathi, PhD
<i>Master of Science</i>	<i>2017-2019</i>	Massachusetts Institute of Technology Biomechatronics Group, MIT Media Lab Thesis: <i>Coordination of lower limb movement utilizing the agonist-antagonist myoneural interface</i> Committee: Hugh Herr, PhD · Neville Hogan, PhD · Edward Boyden, PhD
<i>Bachelor of Science</i>	<i>2012-2016</i>	Georgia Institute of Technology Materials Science and Engineering · minor in Computing and Artificial Intelligence · <i>with highest honors</i>

RESEARCH AND WORK ACTIVITIES

<i>Independent</i>	<i>2024-</i>	Robotics Research Consultant Guide university professors in developing wearable robotics for the rehabilitation of spinal muscular atrophy by establishing investigative goals, designing experiment protocols, and interpreting resulting data.
<i>Massachusetts Institute of Technology</i>	<i>2017-2024</i>	Graduate Researcher — Cambridge, MA Formulated computational approaches for realtime control of bionic limbs using electromyographic signals from amputated musculature · Designed transfemoral implantation and amputation techniques for the rehabilitation of persons with pre-existing amputation · Developed methodologies to quantify cognitive embodiment of bionic limbs. Advisor: Hugh Herr, PhD
<i>Georgia Institute of Technology</i>	<i>2015-2016</i>	Research Project Manager — Atlanta, GA Principal lead for a team of graduate students to implement novel nonlinear control algorithms on a custom powered transfemoral prosthesis. Advisors: Aaron Ames, PhD · Huihua Zhao, PhD
<i>Peking University</i>	<i>May-July 2015</i>	Research Assistant — Beijing, China Designed high-frequency USART and DMA protocols for the determination of joint kinematics on a transtibial prosthesis. Advisors: Qining Wang, PhD · Yanggang Feng, PhD
<i>SpaceX</i>	<i>May-Aug 2014</i>	Propulsion Intern — Hawthorne, CA Developed direct metal laser sintering path-planning algorithms to produce Inconel and titanium superalloy components with extreme geometric overhangs.

PUBLICATIONS

- [1] Tsung-han Hsieh, Hyungeun Song, Christopher Shallal, Daniel Levine, Seong Ho Yeon, Junqing Qiao, **Tony Shu**, Matthew J. Carty, John McCullough, and Hugh M. Herr. "Continuous neural control of a 2-DOF ankle-foot prosthesis enables dynamic obstacle maneuvers after transtibial amputation". In: *Science Robotics* (anticipated 2026).
- [2] **Tony Shu**, John McCullough, Francesca Riccio-Ackerman, Junqing Qiao, Christian Landis, Yanmei Tie, Laura Rigolo, Matthew J. Carty, Corey Sullivan, Ged Weischhoff, Paris Myers, Christopher Shallal, Daniel Levine, Seong Ho Yeon, Ethan Chun, Michael Nawrot, Matthew Carney, and Hugh M. Herr. "Revisional augmentation of residual neuromusculature and training facilitate embodiment and control of a bionic knee prosthesis". In: *Science Translational Medicine* (anticipated 2026).
- [3] Yuebing Li†, Jiaxin Ren†, **Tony Shu†**, Fuzhen Yuan†, and Yanggang Feng†. "Spinal neuromotor rehabilitation using a portable isokinetic training robot". In: *Nature* 654 (2026), pp. 932–940. † Contributed equally.
- [4] John McCullough, Daniel Levine, **Tony Shu**, Rickard Brånemark, Matthew J. Carty, and Hugh M. Herr. "Design and evaluation of a bone-anchored, neurally-controlled knee prosthesis". In: *Journal of NeuroEngineering and Rehabilitation* 23.1 (2026), p. 147.
- [5] Christopher Shallal, Cameron Taylor, Seong Ho Yeon, Richard Casler, Dara Oseyemi, Herrera-Arcos Guillermo, Junqing Qiao, **Tony Shu**, Daniel Levine, Ana Rajcevic, Sean Boerhout, Aimee Liu, Ellen Clarrissimeaux, Joseph Paradiso, Matthew Carney, and Hugh M. Herr. "A wireless magnetic implant system for continuous neuromuscular sensing". In: *Nature Sensors* (2026).
- [6] Gabriel Friedman, **Tony Shu**, Gabriel Feuerwerker, Seong Ho Yeon, Paris Myers, Junqing Qiao, and Hugh M. Herr. "Restoration of proprioception function through a bi-directional human-device neural interface". In: *Neurosurgery* 71.1 (2025), p. 252.
- [7] **Tony Shu**, Daniel Levine, Seong Ho Yeon, Ethan Chun, Christopher Shallal, John McCullough, Rickard Brånemark, Matthew J. Carty, Marco Ferrone, Sean Boerhout, Alexander Ko, Corey L. Sullivan, Gloria Zhu, Michael Nawrot, Matthew Carney, Ged Wieschhoff, Gabriel Friedman, and Hugh M. Herr. "Tissue-integrated bionic knee restores versatile legged movement after amputation". In: *Science* 389.6756 (2025).
- [8] Tsung-han Hsieh, Hyungeun Song, **Tony Shu**, Junqing Qiao, Seong Ho Yeon, Matthew Carney, Luke Mooney, Jean-François Duval, and Hugh M. Herr. "Design, characterization, and preliminary assessment of a two-degree-of-freedom powered ankle-foot prosthesis". In: *Biomimetics* 9.2 (2024), p. 76.
- [9] **Tony Shu**, Guillermo Herrera-Arcos, Cameron Taylor, and Hugh M. Herr. "Mechanoneural interfaces for bionic integration". In: *Nature Bioengineering Reviews* 2.5 (2024), pp. 374–391.
- [10] Hyungeun Song, Tsung-han Hsieh, Seong Ho Yeon, **Tony Shu**, Michael Nawrot, Christian Landis, Gabriel N. Friedman, Erica A. Israel, Samantha Gutierrez-Arango, Matthew J. Carty, Lisa E. Freed, and Hugh M. Herr. "Continuous neural control of a bionic limb restores biomimetic gait after amputation". In: *Nature Medicine* 30.7 (2024), pp. 2010–2019.
- [11] Corey Sullivan, **Tony Shu**, Lori Berger, Rachel Chiao, Kendall Clites, Marco Ferrone, Richard O'Donnell, Rickard Brånemark, Hugh Herr, and Matthew Carty. "Transfemoral amputation incorporating eOPRA and agonist-antagonist myoneural interface (AMI) design: surgical technique and perioperative care". In: *Plastic and Reconstructive Surgery Global Open* 11.10 (2023), pp. 133–134.

- [12] **Tony Shu**, Christopher Shallal, Ethan Chun, Aashini Shah, Angel Bu, Daniel Levine, Seong Ho Yeon, Matthew Carney, Hyungeun Song, Tsung-Han Hsieh, et al. "Modulation of prosthetic ankle plantarflexion through direct myoelectric control of a subject-optimized neuromuscular model". In: *IEEE Robotics and Automation Letters* 7.3 (2022), pp. 7620–7627.
- [13] Matthew E Carney, **Tony Shu**, Roman Stolyarov, Jean-François Duval, and Hugh M Herr. "Design and preliminary results of a reaction force series elastic actuator for bionic knee and ankle prostheses". In: *IEEE Transactions on Medical Robotics and Bionics* 3.3 (2021), pp. 542–553.
- [14] **Tony Shu**, Shan Shan Huang, Christopher Shallal, and Hugh M Herr. "Restoration of bilateral motor coordination from preserved agonist-antagonist coupling in amputation musculature". In: *Journal of NeuroEngineering and Rehabilitation* 18.1 (2021), pp. 1–17.
- [15] Seong Ho Yeon, **Tony Shu**, Hyungeun Song, Tsung-Han Hsieh, Junqing Qiao, Emily A Rogers, Samantha Gutierrez-Arango, Erica Israel, Lisa E Freed, and Hugh M Herr. "Acquisition of surface EMG using flexible and low-profile electrodes for lower extremity neuroprosthetic control". In: *IEEE Transactions on Medical Robotics and Bionics* 3.3 (2021), pp. 563–572.
- [16] Seong Ho Yeon, **Tony Shu**, Emily A Rogers, Hyungeun Song, Tsung-Han Hsieh, Lisa E Freed, and Hugh M Herr. "Flexible dry electrodes for EMG acquisition within lower extremity prosthetic sockets". In: *2020 8th IEEE RAS/EMBS International Conference for Biomedical Robotics and Biomechatronics (BioRob)*. IEEE. 2020, pp. 1088–1095.
- [17] Vahid Azimi, **Tony Shu**, Huihua Zhao, Rachel Gehlhar, Dan Simon, and Aaron D Ames. "Model-based adaptive control of transfemoral prostheses: Theory, simulation, and experiments". In: *IEEE Transactions on Systems, Man, and Cybernetics: Systems* 51.2 (2019), pp. 1174–1191.
- [18] Vahid Azimi, **Tony Shu**, Huihua Zhao, Eric Ambrose, Aaron D Ames, and Dan Simon. "Robust control of a powered transfemoral prosthesis device with experimental verification (**Best Paper Finalist**)". In: *2017 American Control Conference (ACC)*. IEEE. 2017, pp. 517–522.

SELECTED AWARDS AND HONORS

2024, MIT McGovern Institute Research Poster Award
 2022-2023, MIT Sandbox Innovation Fund
 2022, MIT ProjX Innovation Initiative
 2020, 1st Place - MIT Assistive Technology Hackathon
 2018, National Science Foundation Graduate Research Fellowship
 2016, 1st Place - IISE Paper Competition
 2016, 1st Place - Georgia Tech Capstone Expo
 2016, Art Cox Scholarship
 2015, TE Stribling Textile Fund
 2013, Georgia Tech Materials Science Research Scholarship
 2012-2016, Zell Miller Scholarship
 2012-2016, Jack J. and Leda Zbar Scholarship
 2009-2012, GMEA All-State and District Honor Bands

PROFESSIONAL AND SOCIAL ACTIVITIES

<i>Events</i>	2026, Beihang University, School of Mechanical Engineering and Automation, invited presenter 2026, MIT Introduction to Engineering and Science program, invited interviewee 2026, Deutschlandfunk radio, invited interviewee 2025, Naked Scientists podcast, invited interviewee 2025, WBZ News Radio, invited interviewee 2025, Deutschlandfunk radio, invited interviewee 2025, Smithsonian Magazine, invited interviewee 2025, Boston Globe news, invited interviewee 2025, El País news, invited interviewee 2024, Peking University, Beijing Engineering Research Center for Intelligent Rehabilitation Engineering, invited presenter 2024, Beihang University, School of Mechanical Engineering and Automation, invited presenter
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2024, Wuhan University, Medical Research Institute, invited presenter
 2024, Global Collaborative Congress on Osseointegration, invited presenter
 2024, MIT Yang Tan Collective Seminar, presenter
 2022, MIT K. Lisa Yang Center for Bionics Retreat, presenter
 2022, MIT K. Lisa Yang Center for Bionics Launch Event, presenter
 2022, MIT Better World Expo, presenter
 2022, IEEE RAS/EMBS BioRob Conference, presenter
 2022, Schmidt Science Fellows Media Lab Visit, presenter
 2022, Université Mohammed 6 Polytechnique Week of Science, invited speaker
 2022, Stanford Existential Risks Conference, invited participant
 2021, CIA Media Lab Visit, presenter
 2021, DARPA Media Lab Visit, presenter
 2019, DARPA HAPTIX Conference, invited participant
 2018, TED, participant
 2017-2023, MIT Media Lab Members' Week, presenter
 2015, JPMorgan Chase Code for Good, invited participant

*Organizing and
Reviewing*

2023, IEEE RAS/EMBS ICORR, invited reviewer
 2021, Nature Medicine, reviewer
 2020, IEEE RAS/EMBS BioRob Conference, invited reviewer
 2020, Curious Science Writers, invited reviewer
 2017, Boston Open Researcher Group Software Development Workshop, organizer

Associations

2022-2023, Brigham and Women's Hospital, research associate
 2022-2023, IEEE, member
 2018-2022, DARPA WBA160599, investigator
 2015-2016, Tau Beta Pi, member

TEACHING AND MENTORSHIP

Academic

2023, MIT MAS.600 Human Augmentation Technologies, invited panelist
 2022, MIT 2.S972 Virtualizing the Human Body, invited lecturer
 2019-2020, MIT Summer Research Program, invited mentor
 2018-2020, MIT MAS.600 Human Augmentation Technologies, Head TA
 2017, MIT Media Lab Freshman Program, invited lecturer
 2016, Georgia Tech MSE4022 Ceramics Fabrication Lab, Head TA
 2016, Georgia Tech MSE3021 Thermal Properties Lab, Head TA

*Undergraduates
Mentored*

Melissa Klein, MIT
 Ethan Chun, MIT
 Gloria Zhu, MIT
 Sean Boerhout, MIT
 Alexander Ko, Harvard
 Aashini Shah, MIT
 Isabelle Liu, MIT
 Christopher Shallal, Johns Hopkins
 Shan Shan Huang, MIT
 Diana Voronin, MIT
 Kit McArthur, Harvard
 Irene Terpstra, MIT
 Austin Edelman, MIT
 Angel Bu, Florida State
 John Batzer, Penn State

*Postgraduates
Mentored*

Paris Myers, Oregon State
 John McCullough, UCLA

Theses Supervised

Gabriel Feuerwerker, M.S., EPFL

Interpersonal

2018-2024, MIT Graduate Resident Advisor
 2013-2016, Georgia Tech Undergraduate Resident Advisor

Leadership

2018-2022, DARPA HAPTIX W911NF-17-2-0043, Project Manager
 2020, HackMIT, mentor
 2017-2018, MIT Ashdown House, house photographer
 2017-2018, MIT Ashdown House, house photographer
 2015-2016, Yellow Jacket Archery Club, president

OTHER INFORMATION

*Selected
Coursework*

Biomechanics and Neural Control of Movement · Digital Control Systems · Linear and Nonlinear Control Theory · Linear and Nonlinear Optimization · Underactuated Robotics · Advanced Systems Dynamics and Modeling · Digital Signals Processing · Discrete Math and Combinatorics · Computer Systems Architecture · Machine Learning and Knowledge-based AI · Advanced Data Structures and Algorithms · Thermodynamics and Mass Transport · Ceramic, Metal, and Polymer Processing · Thin Film Fabrication · Electrical, Optical, and Quantum Properties of Materials

Selected Interests

Humanoid Robotics · Theoretical Biomechanics · Data Visualization · CAD and Circuit Design · Machining and Welding · Carpentry and Fiberglass · Mechanical, Electrical, and Hydraulic System Design · Videography and Photography · AV Production · Audio Engineering · Soil and Water Chemistry · Fermentation Processes · Continental Philosophy

Sailing Accolades

July 16 2022, MA Constitution Cup, line honors
 July 9 2022, MA S.S Crocker Memorial Race, first in class
 2022, MIT Bluewater Crew Rating
 2021, MIT Nautical Association Provisional Rating · MIT Dinghy · Firefly · 420 · Laser · Lynx Catboat · Board Sailing

October 19, 2026