Trevor W. Exley

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Personal Statement

Dedicated and diligent researcher in soft biorobotics with focus on thermo-active soft actuators, monolithic systems, variable impedance, and physical human–robot interaction (pHRI).

Education

Ph.D., Biomedical Engineering, University of North Texas 2021–2024
Supervisor: Amir Jafari. Dissertation: "Thermo-Reversible Phase-Change Actuators for Physical Human–Robot Interactions". GPA: 4.00/4.00.

M.S., Biomedical Engineering, University of North Texas 2020–2021
Thesis: "Parkinson's Disease and UPDRS-III Prediction Using Quiet Standing Data and Applied Machine Learning". GPA: 4.00/4.00.

B.S., Biomedical Engineering (summa cum laude), University of North Texas 2017–2020
Minors: Mathematics, Mechanical Engineering. GPA: 3.94/4.00, rank 295/3883.

Appointments

Postdoctoral Researcher, Soft Biorobotics Perception Research Line, Istituto Italiano di Tecnologia (IIT), Genova 2024–Present

PhD Candidate & Researcher, Advanced Robotic Manipulators Lab, University of North Texas 2021–2024

Lab Affiliated, Biomedical AI Lab, University of North Texas 2020–2023

Peer-Reviewed Publications

(* = corresponding author; † = co-corresponding author)

Submitted / Under Revision

[C.6] **T. Exley**, A. B. Nardin, P. Trunin, D. Cafiso, L. Beccai. Monolithic Units: Actuation, Sensing, and Simulation for Integrated Soft Robot Design. Submitted to *IEEE RoboSoft* 2026. *(submitted)*

[J.13] P. Trunin, D. Cafiso, A. B. Nardin, **T. Exley**†, L. Beccai. MELEGROS: Monolithic Elephant-inspired Gripper with Optical Sensors. Submitted to *Advanced Science* (2025). *submitted*

[J.12] **T. Exley**, D. Johnson, A. Jafari. Estimating Stiffness and Damping of a Novel Variable Impedance Actuator based on Adjusting Viscoelastic Properties of Thermoresponsive Polycaprolactone in Harmonic Motions. Submitted to *Scientific Reports. (under revision)*

[J.11] D. Johnson, **T. Exley**, M.-A. Torres, J. Slayton, M. Ecker, A. Jafari. Tailoring Silicone Mixtures for Soft Robotics: Predictive Modeling and Experimental Validation in Pneumatic Soft Actuators. Original Manuscript Ref: BMM-106977. *(under revision)*

In Press / Published

[J.10] **T. Exley**, R. Wijesundara, S. Wang, A. Moridani, T. Nilforooshan, A. Jafari. TVIM: Thermoactive Variable Impedance Module Evaluating Shear-Mode Capabilities of Polycaprolactone. *IEEE Access* (2025).

[C.5] J. Jenkins, O. Madera, C. Guerrero, K. Humes, A. Malmquist, C. Renfrew, Q. Bakker, K. Siu, **T. Exley**, A. Jafari. Design and Implementation of a High-Precision Motor Control System for Adjustable-Stiffness Biomedical Treadmills. In *Proc. IEEE 18th Dallas Circuits and Systems Conf. (DCAS)*, 1–6 (2025).

[C.4] F. Tajomi, **T. Exley**, A. Jafari. Development of a Miniature Thermal-Based Variable Impedance Actuator Using Thermoplastic Polymers for Scalable and Compact Robotic Applications. In *Proc. IEEE 18th Dallas Circuits and Systems Conf. (DCAS)*, 1–6 (2025).

[C.3] **T. Exley**, R. Wijesundara, N. Tan, A. Sunkara, X. He, S. Wang, B. Chan, A. Jain, L. Espinosa, A. Jafari. Agonist–Antagonist Pouch Motors: Bidirectional Soft Actuators Enhanced by Thermally Responsive Peltier Elements. In *IEEE/RSJ IROS* (2024).

[C.2] K. Ruiz, S. Ryan, S. Stutsman, T. Tirumala, J. Williams, R. Wijesundara, **T. Exley**, A. Jafari. Design considerations of Peltier-Integrated Therapeutic Wrist Wrap for Medical Applications. *2024 46th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)* (2024)

[J.9] **T. Exley**, D. Johnson, A. Jafari. Comparative Analysis of Peltier Devices and Flexible Heater Strips for Enhancing Bandwidth in Thermo-Active Soft Actuators. *Journal of Medical Robotics Research* 9(03n04):2450002 (2024).

[J.8] **T. Exley**, E. Hays, D. Johnson, A. Moridani, R. Motati, A. Jafari. Toward a Unified Naming Scheme for Thermo-Active Soft Actuators: A Review of Materials, Working Principles, and Applications. *Robotics Reports* 2(1):15–28 (2024).

[J.7] **T. Exley**, D. Johnson, A. Jafari. A Novel Variable Impedance Actuator Utilizing Adjustable Viscoelastic Properties of Thermoresponsive Polycaprolactone. *Robotics Reports* 1(1):57–66 (2023).

[J.6] **T. Exley**, D. Johnson, A. Jafari. Towards a Novel Thermal-Based Variable Impedance Module through Adjusting Viscoelastic Properties of a Thermoresponsive Polymer. *IEEE Transactions on Medical Robotics and Bionics*, 1–1 (2023).

[J.5] **T. Exley**, D. Johnson, A. Jafari. Utilizing the Peltier Effect for Actuation of Thermo-Active Soft Robots. *Smart Materials and Structures* (2023).

[J.4] E. Hays, J. Slayton, G. Tejeda-Godinez, E. Carney, K. Cruz, **T. Exley**, A. Jafari. A Review of Rehabilitative and Assistive Technologies for Upper-Body Exoskeletal Devices. *Actuators* 12 (Soft Robotics in Biomedical Application):178 (2023).

[C.1] Z. Liu, **T. Exley**, A. Meek, R. Yang, H. Zhao, M. V. Albert. Predicting GPU Performance and System Parameter Configuration Using Machine Learning. In *IEEE ISVLSI*, 253–258 (2022).

[J.3] **T. Exley**, S. Moudy, R. M. Patterson, J. Kim, M. V. Albert. Predicting UPDRS Motor Symptoms in Individuals with Parkinson's Disease from Force Plates Using Machine Learning. *IEEE Journal of Biomedical and Health Informatics* 26(7):3486–3494 (2022).

[J.2] **T. Exley**, A. Jafari. Increasing Robustness and Output Performance of Variable Stiffness Actuators in Periodic Motions. *Mechanism and Machine Theory* 169:104645 (2022).

[J.1] **T. Exley**, A. Jafari. Maximizing Energy Efficiency of Variable Stiffness Actuators through an Interval-Based Optimization Framework. *Sensors and Actuators A: Physical* 332:113123 (2021).

Patents

[P.4] R. Kaleigh, S. Ryan, S. Stutsman, T. Tirumala, J. Williams, R. Wijesundara, **T. Exley**, A. Jafari. **Peltier-integrated therapeutic wrap**. US Patent App. 18/649,757 (2024).

[P.3] E. Hays, E. Carney, K. Cruz, J. Slayton, G. Tejeda-Godinez, **T. Exley**, A. Jafari. **Devices for biomechanical assistance including an exoskeleton and a robotic glove**. US Patent App. 18/649,708 (2024).

[P.2] A. Jafari, **T. W. Exley**. **Thermal-based variable impedance actuator**. US Patent App. 18/418,008 (2024).

[P.1] A. Jafari, **T. W. Exley**. **Thermoactivate modular soft actuator based on phase transition**. US Patent App. 18/417,801 (2024).

Grants & Funding

NIH G-RISE (T32GM136501) 2021-2024
Amount: $109,318 USD.

Teaching Experience

Teaching Fellow, Dept. of Biomedical Engineering, University of North Texas Summer 2021
BMEN 2320: Biomedical Instrumentation. Refined curriculum for hybrid delivery; delivered core instrumentation content.

Teaching Assistant, Dept. of Biomedical Engineering, University of North Texas 2020–2021
Created lab curriculum for 80-student course; independently graded assignments and exams.

Teaching

Traditional courses

[1] **BMEN 2320: Biomedical Instrumentation**

External courses, tutorials, and workshops

[2] **Soft Robotics in i4.0** Robotics in Industry 4.0: Challenges and Opportunities
University of Texas at San Antonio, Summer 2022

Research Supervised

Direct, Individual

Anita Stephanie Akpu — Undergraduate	Sep 2023 – May 2024
Rachel Evers — Undergraduate	Sep 2023 – May 2024
Kendra Green — Undergraduate	Sep 2023 – May 2024
Joanna Thirunilathu — Undergraduate	Sep 2023 – May 2024
Bonnie Chan — TAMS Student [C.3]	Sep 2023 – May 2024
Luis Espinosa — TAMS Student [C.3]	Sep 2023 – May 2024
Xinyu (Hebe) He — TAMS Student [C.3]	Sep 2023 – May 2024
Aditya Jain — TAMS Student [C.3]	Sep 2023 – May 2024
Akshay Sunkara — TAMS Student [C.3]	Sep 2023 – May 2024
Nathan Tan — TAMS Student [C.3]	Sep 2023 – May 2024
Shuopu Wang — TAMS Student [C.3]	Sep 2023 – May 2024
Arian Moridani — Undergraduate [J.8]	Mar 2023 – May 2024
Ramya Motati — TAMS Student [J.8]	Apr 2023 – Dec 2023
Kalyan Adhikari — TAMS Student	Jun 2022 – Feb 2023

Direct, Group

Omar Madera, Cristian Guerrero, James Jenkins [C.5] EE Senior Capstone	Aug 2023 – Aug 2024
Jack Slayton, Emilly Hays, Emily Carney, Kobe Cruz, Gary Tejeda-Godinez [P.3] [J.4] BME Senior Capstone	Aug 2022 – May 2023
Sarah Stutsman, Tanya Tirumala, Samantha Ryan, Jatara Williams, Kayleigh Ruiz [P.4] [C.2] BME Senior Capstone	Aug 2022 – May 2023

Talks (selected)

[2] Global Ethicon R&D: "Thermo-Reversible Phase-Change Actuators for Physical Human–Robot Interactions"   Feb 15, 2023

[1] University of North Texas Health Science Center: "Introduction to Machine Learning"   Jun 11, 2021

Outreach

Robotics and AI presentations at Richardson IQ (Innovation Quarter) and Parr Library (2023).

Service

Editorial: Co-guest editor, *Actuators* Special Issue "Soft Robotics in Biomedical Application".
Reviewer: IEEE Access; IEEE Robotics and Automation Letters; IEEE Transactions on Robotics; IROS; RoboSoft; ICORR (various years).

Professional Experience

[2] **Chief Executive Officer**, Robotics and STEM LLC   2023–2024

[1] **Biomedical Internship**, Bridging Biosciences LLC   2019

Awards

[4] Outstanding Ph.D. Graduate, University of North Texas (2024)

[3] Outstanding M.S. Student, University of North Texas (2021)

[2] Outstanding Senior; Distinguished Honors College Scholar; UNT Excellence Scholarship (2020)

[1] Esports Scholarship, UNT Varsity League of Legends Team (2019–2020)

Skills

SolidWorks, SolidWorks CAM, Autodesk, Rhinoceros 3D, Grasshopper 3D, 3D printing, FEA, C/C++, MATLAB, LabVIEW, Python, Machine Learning

Professional Memberships

Institute of Electrical and Electronics Engineers (IEEE); Biomedical Engineering Society (BMES)