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 (*p*HRI). Passionate about rigorous, reproducible methods and practical, human-centered systems.

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.

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

Submitted / Under Revision

[18] **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)*

[17] 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*

[16] **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)*

[15] 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

[14] **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).

[13] J. Jenkins, O. Madera, C. Guerrero, K. Humes, A. Malmquist, C. Renfrew, *et al.*, **T. Exley**. 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).

[12] 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).

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

[10] **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).

[9] **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).

[8] **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).

[7] **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).

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

[5] 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).

[4] 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).

[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).

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

[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

[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).

[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).

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

[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)
Amount: $109,318 USD.

Teaching

Teaching Fellow, Dept. of Biomedical Engineering, University of North Texas Jun–Aug 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.

Mentoring (abridged)

Direct supervision of undergraduates and high-school researchers on thermo-active actuators, motion capture (OptiTrack), ROS for humanoid platforms, and soft robotic glove development. Details available on request.

Talks (selected)

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

[1] University of Texas San Antonio: "Soft Robotics in Industry 4.0" Jun 17, 2022

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
Led soft actuation technology development and K–12 robotics programs (3D printing, circuits, coding, design).

[1] **Biomedical Internship**, Bridging Biosciences LLC 2019
R&D toward patentable medical devices.

Awards

[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)

References

*Amir Jafari, Ph.D., Associate Professor, University of North Texas. amir.jafari@unt.edu
Vijay Vaidyanathan, Ph.D., Founding Chair of Biomedical Engineering, University of North Texas. Vijay.Vaidyanathan@unt.edu
Logan Porter, Ph.D., Assistant Professor, Texas A&M University. lporter1@tamu.edu
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Mark V. Albert, Ph.D., Associate Chair, Graduate Studies, University of North Texas. mark.albert@unt.edu