

Mason Zadan

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EDUCATION

Carnegie Mellon University

PhD Candidate, Soft Machines Lab, Mechanical Engineering Department

Advisor: Carmel Majidi

September 2020-present

Pittsburgh, PA

Tentative Thesis Title: Soft Matter Thermoelectric Generators for Wearable Energy Harvesting and Soft Robotics

Relevant Courses: Principles of Soft-Matter Machines & Electronics, Soft Robots: Mechanics, Design and Modeling, Applied Gadgets, Sensors and Activity Recognition in HCI, Direct Solar and Thermal Energy Conversion, Solid State Devices for Energy Conversion, Numerical Methods

University of Richmond

Bachelor of Science in Physics with a Minor in Mathematics

Honors: Magna Cum Laude

Relevant Courses: Electricity and Magnetism, Differential Geometry, Biophysics, Quantum Mechanics, Modern Physics, Mathematical Methods, Computational Methods, Classical Mechanics, Statistical Mechanics, Multivariate Calculus, Intermediate Laboratory, Linear Algebra, and Differential Equations

May 2020

Richmond, VA

PREVIOUS RESEARCH EXPERIENCE

Research Scientist Internship

Meta Reality Labs, Redmond, Washington

May 2023-August 2023

- Developed wearable hardware solutions for AR and VR applications
- Collaborated with research scientists and managers on researching next generation wearable solutions
- Fabricated samples, conducted testing, and reported results during periodic research updates

Summer Research Fellowship

Institute of Systems and Robotics, University of Coimbra, Coimbra, Portugal

July 2019-August 2019

- Implemented stretchable thermoelectric generator technology to power temperature and humidity sensor
- Collaborated with Institute of Systems and Robotics researchers to identify implementation strategies and power requirements for various wearable and small electronic devices

Summer Research Fellowship

Soft Machines Lab, Department of Mechanical Engineering, Carnegie Mellon University

May 2019-July 2019

- Built first of its kind liquid metal embedded thermoelectric generator (TEG) energy harvester
- Created and characterized uniquely stretchable and bendable wearable energy harvester for wearable electronics applications
- Paper published in ACS Applied Materials & Interfaces
- Authored conference paper for Behavior and Mechanics of Multifunctional Materials XV

Summer Research Fellowship

Soft Machines Lab, Department of Mechanical Engineering, Carnegie Mellon University

May 2018-August 2018

- Created computer modeling for nano-composite materials
- Built model to find ideal fill percentages (percolation thresholds) of EGaIn and silver nano-rod embedded elastomer composite materials
- Designed model using a square lattice graph and recursive pathfinding algorithm to compute percolation thresholds for electrical conductivity of composite elastomers

AWARDS AND SCHOLARSHIPS

Awards & Honors

- 3rd Place American Society of Mechanical Engineers SMASIS 2022 Conference Best Student Paper Competition
- University of Richmond School of Arts and Sciences Best Paper in the Natural Sciences Award 2020
- The Jackson J. Taylor Best Senior Seminar in Physics Award
- Sigma Pi Sigma Physics Honor Society
- Pi Mu Epsilon Math Honor Society
- Phi Eta Sigma Honor Fraternity
- High School Valedictorian

Scholarships and Grants

- Richmond Science Scholar
Awarded \$200,000 Merit-based full tuition scholarship for four years
45 Scholars selected from 5,500 applicants
- Richmond Scholars Enrichment Grant
Awarded \$3,000 for travel and living expenses during research fellowship in Coimbra, Portugal
- Richmond Guarantee Grant
Awarded \$3,200 to conduct research on deformable electrically conductive nano-composite materials

PUBLICATIONS

Total Citation Record – *Google Scholar*: citations = 268, h-index= 5

Journal Publications

- Abdelrahman, M. K.; Wagner, R. J.; Kalairaj, M. S.; **Zadan, M.**; Kim, M. H.; Jang, L. K.; Wang, S.; Javed, M.; Dana, A.; Singh, K. A.; Hargett, S. E.; Gaharwar, A. K.; Majidi, C.; Vernerey, F. J.; Ware, T. H. Material Assembly from Collective Action of Shape-Changing Polymers. *Nat. Mater.* 2024, 1–9.
- **Zadan, M.**; Patel, D. K.; Sabelhaus, A. P.; Liao, J.; Wertz, A.; Yao, L.; Majidi, C. Liquid Crystal Elastomer with Integrated Soft Thermoelectrics for Shape Memory Actuation and Energy Harvesting. *Advanced Materials* 2022, 34 (23), 2200857.
- Won, P.; Valentine, C. S.; **Zadan, M.**; Pan, C.; Vinciguerra, M.; Patel, D. K.; Ko, S. H.; Walker, L. M.; Majidi, C. 3D Printing of Liquid Metal Embedded Elastomers for Soft Thermal and Electrical Materials. *ACS Appl. Mater. Interfaces* 2022, 14 (49), 55028–55038.
- Roberts, P.; **Zadan, M.**; Majidi, C. Soft Tactile Sensing Skins for Robotics. *Curr Robot Rep* 2021, 2 (3), 343–354.
- **Zadan, M.**; Chiew, C.; Majidi, C.; Malakooti, M. H. Liquid Metal Architectures for Soft and Wearable Energy Harvesting Devices. *Multifunct. Mater.* 2021, 4 (1), 012001.
- **Zadan, M.***; Malakooti, M. H.*; Majidi, C. Soft and Stretchable Thermoelectric Generators Enabled by Liquid Metal Elastomer Composites. *ACS Appl. Mater. Interfaces* 2020, 12 (15), 17921–17928.

Peer-reviewed Conference Proceedings

- Song, Y.; **Zadan, M.**; Misra, K.; Li, Z.; Wang, J.; Majidi, C.; Kumar, S. Navigating Soft Robots through Wireless Heating. In 2023 IEEE International Conference on Robotics and Automation (ICRA); IEEE: London England, 2023; pp 2598–2605.
- Wang, J.; Song, Y.; **Zadan, M.**; Shen, Y.; Chen, V.; Majidi, C.; Kumar, S. Wireless Actuation for Soft Electronics-Free Robots. In Proceedings of the 29th Annual International Conference on Mobile Computing and Networking; ACM: Madrid Spain, 2023; pp 1–16.
- **Zadan, M.**; Patel, D. K.; Malakooti, M. H.; Yao, L.; Majidi, C. Fabrication of 3D Printed Thermoelectric Devices for Integration into Liquid Crystal Elastomer Actuators. In Proceedings of the ASME 2022 Conference on Smart Materials, Adaptive Structures and Intelligent Systems; ASME: Dearborn, Michigan, USA, 2022; Vol. 86274.
- Malakooti, M. H.; **Zadan, M.**; Kazem, N.; Majidi, C. Liquid Metal Composites for Flexible Thermoelectric Energy Harvesting. In Behavior and Mechanics of Multifunctional Materials XV; SPIE: Online, 2021; Vol. 11589, pp 57–64.

Under Review or in Preparation

- **Zadan, M.**; Wertz, A.; Shah, D.; Patel, D. K.; Zu, W.; Han, Y.; Gelorme, J.; Mea, H. J.; Yao, L.; Malakooti, M. H.; Ko, S. H.; Kazem, N.; Majidi, C. Stretchable Thermoelectric Generators for Self-Powered Wearable Health Monitoring. *Nature Electronics*, Under Review.
- Song, Y.; Li, Z.; **Zadan, M.**; Wang, J.; Majidi, C.; Kumar, S. Low-Power Radio-Frequency Actuation for Soft Robots. In-preparation.

WORKSHOPS AND CONFERENCE PRESENTATIONS

- **Zadan, M.**; Wang, J.; Song, Y.; Patel, D. K.; Li, Z.; Yao, L.; Kumar, S.; Majidi, C. Wireless and Thermoelectric Actuation Methods for Liquid Crystal Elastomer Based Soft Robots. *International Liquid Crystal Elastomer Conference*. October, 2023.

- **Zadan, M.**; Patel, D. K.; Wertz, A.; Shah, D.; Kazem, N.; Majidi, C. Stretchable Thermoelectric Generators and Peltier Coolers for Wearable Applications. *SEMICON West*. July, 2023.
- **Zadan, M.**; Patel, D. K.; Majidi, C. Soft and Stretchable Composite Materials for Wearable Thermoelectric Body Thermoregulation and Energy Harvesting. *39th Annual Semiconductor Thermal Measurement, Modeling and Management Symposium*. March, 2023.
- **Zadan, M.**; Patel, D. K.; Majidi, C. Stretchable 3D Printed Thermoelectric Generators for Liquid Crystal Elastomer Actuation, Control and Energy Recovery. *Materials Research Society Fall Meeting*. December, 2022.
- **Zadan, M.**; Majidi, C. Characterization of Liquid Crystal Elastomer with Integrated Soft Thermoelectrics Enabling Actuation and Energy Harvesting. Workshop on *Determining Appropriate Metrics and Test Methods for Soft Actuators in Robotic Systems, International Conference on Robotics and Automation (ICRA)*. May, 2022.

REVIEWER FOR JOURNALS

- RSC: Soft Matter Book Series, 2024
- IOP: Engineering Research Express, 2023
- IOP: Journal of Physics: Energy, 2023
- ACS: Energy Letters, 2021

LEADERSHIP AND TEACHING POSITIONS

Laboratory Manager *September 2021-present*

Soft Machines Lab, Department of Mechanical Engineering, Carnegie Mellon University

- Conduct training for over 20 masters, PhD, and postdocs on proper lab protocols and safety practices
- Manage hazardous waste protocols and removal
- Implement and devise lab safety and cleaning procedures
- Manage chemical inventories

Teaching Assistant

Spring 2022, 2023

Soft Robots: Mechanics, Design and Modeling

Instructor: Carmel Majidi

- Mentored students on a host of soft robotics projects giving design and characterization feedback
- Directed student's projects through evaluation of literature reviews and mid-semester and final reports

OUTREACH

Senior Reviewer

January 2024-present

Associate Reviewer

March 2023-January 2024

Reviewer

August 2022-March 2023

Journal of Emerging Investigators (JEI)

- Volunteer at JEI, a non-profit graduate student run open-access journal publishing middle and high school students' research
- Review scientific manuscripts submitted by middle and high school students to mentor, guide, and introduce students to the scientific review process.

SELECT SKILLS

- Mathematica
- LaTeX
- SEM, EDS Imaging
- Instron
- FLIR thermal camera
- Solidworks, Fusion 360
- Hyrel 3D printer
- Liquid crystal elastomer fabrication
- Liquid metal materials processing