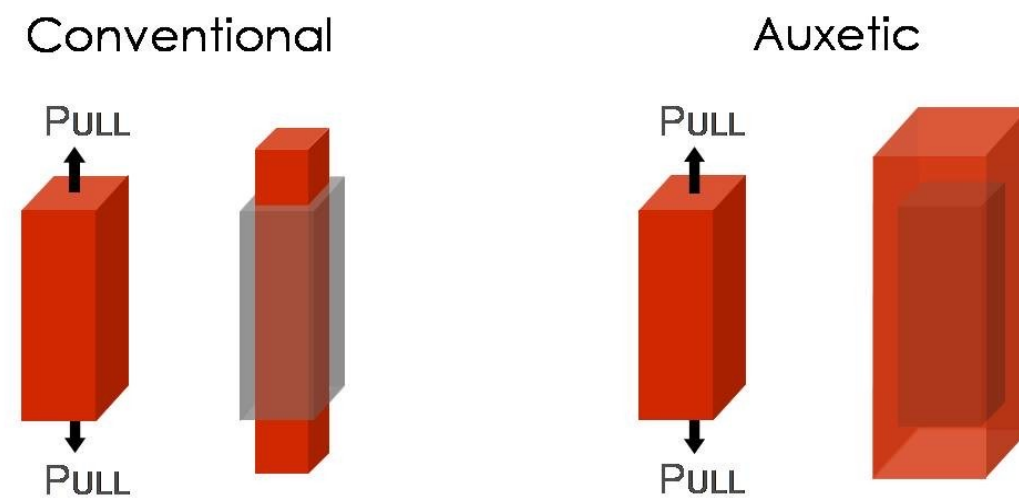


Introduction

- **Metamaterials:** synthetic materials that have unnatural properties
- **Negative Poisson's Ratio:** expand in a perpendicular direction when stretched
- **Auxetic Metamaterials:** synthetic material with a negative Poisson's Ratio
- **Kirigami:** the Japanese art of paper cutting



Objective

Design a 2D material with kirigami patterns to obtain a negative Poisson's Ratio

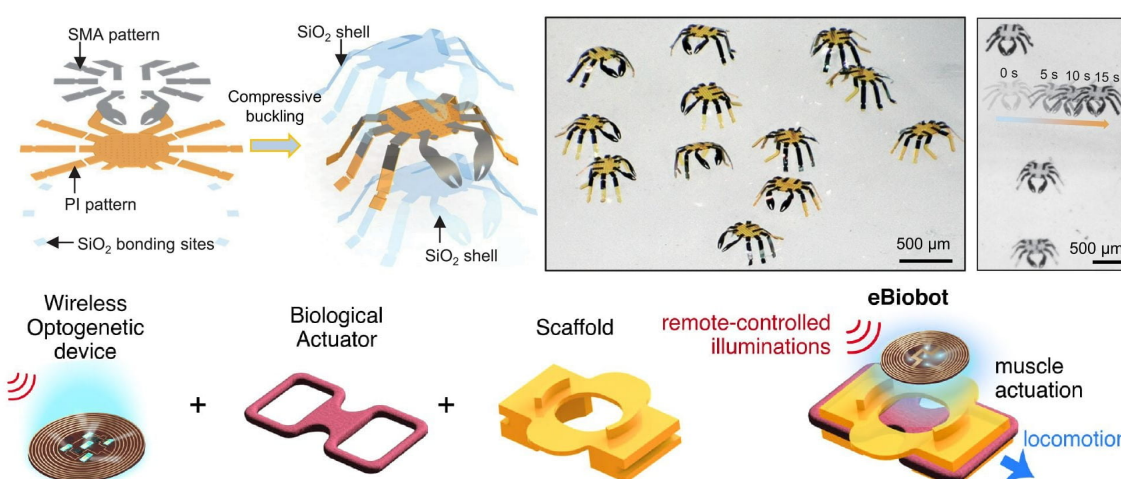
Impact of Professor's Research

Soft Robots

- Deployable robots that can deform

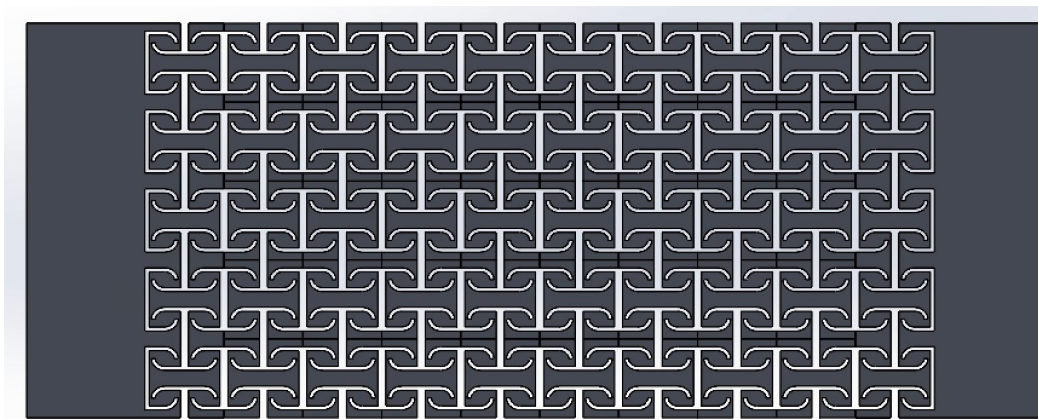
Biomedical Devices

- Electronic sensors in muscles
- Conformability to human body
- Interact properly with bodily functions

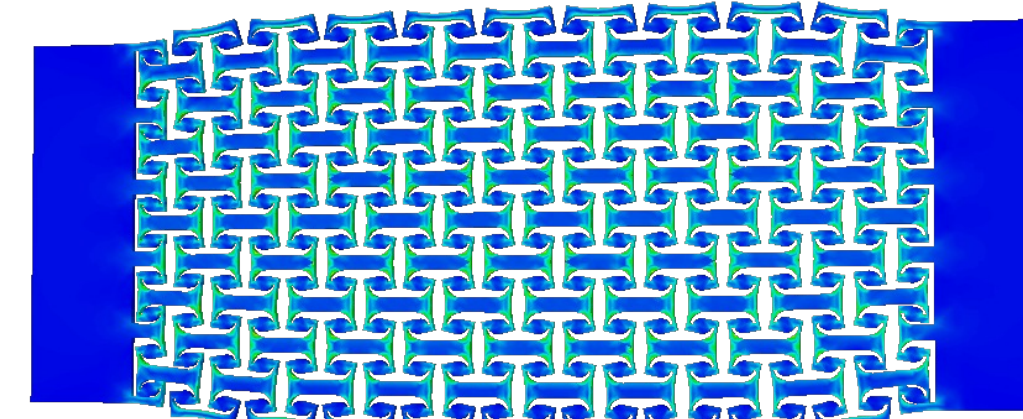


Methods & Results

Design



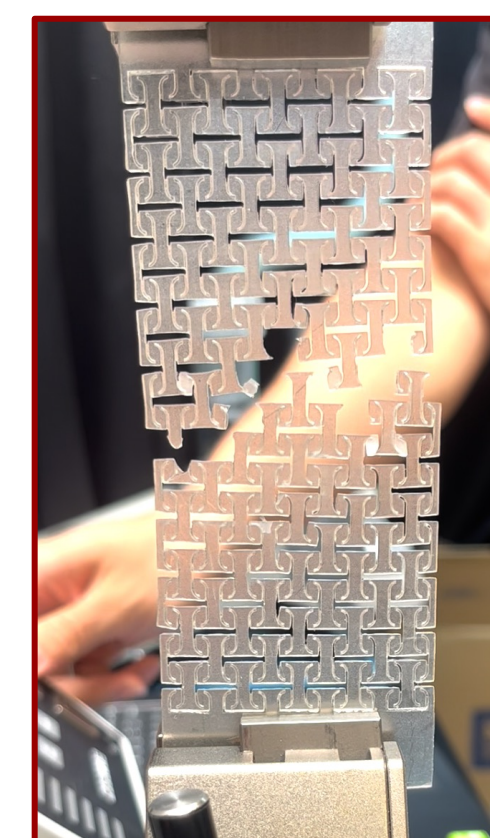
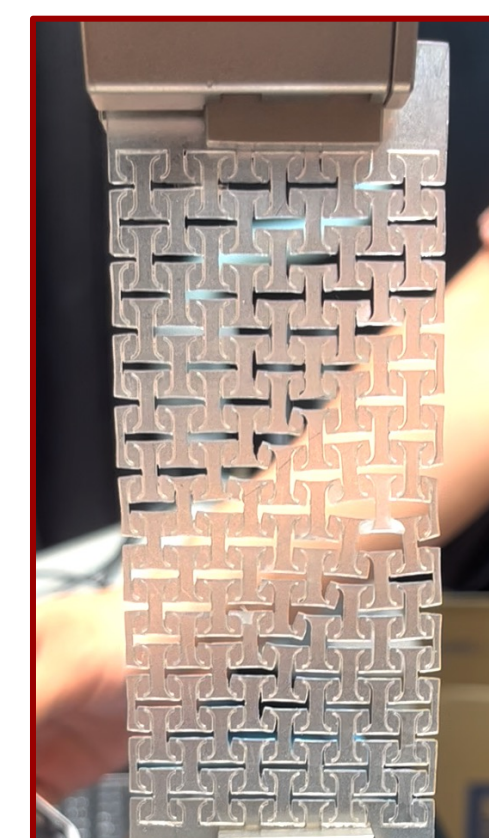
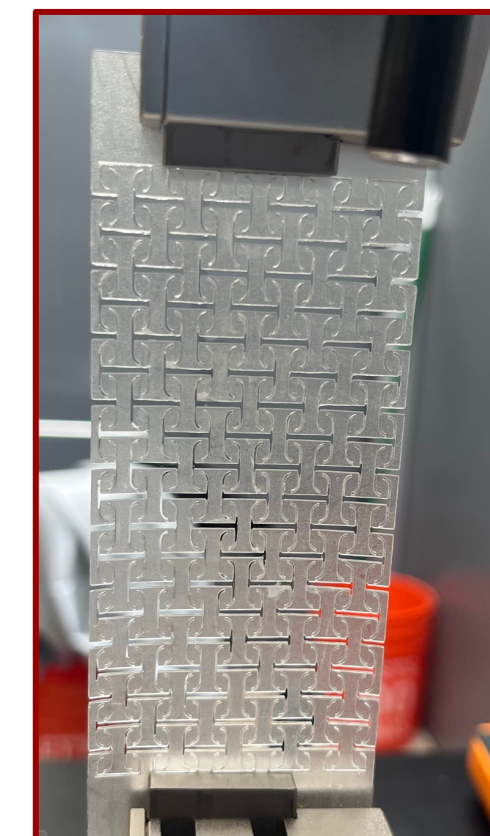
Simulation



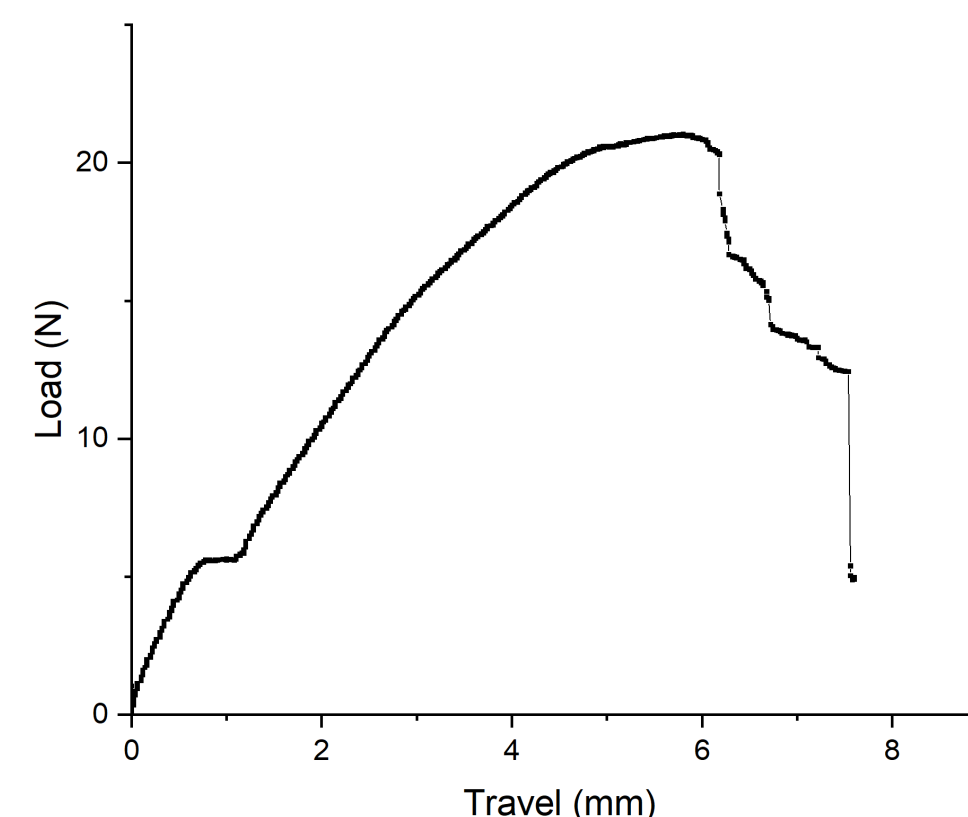
Manufacturing



Experiments Trials



Data Plot



Learning Process & Skills Learned



Next Steps for My Research

- Fix out of plane buckling issues
- Enlarge the model to ease manufacturing
- Run more experimental trials
- Consider using a laser cutter

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Citations

- [1] A. K. Brooks, S. Chakravarty, M. Ali, and V. K. Yadavalli, "Kirigami-Inspired Biodesign for Applications in Healthcare," *Advanced Materials (Weinheim)*, vol. 34, no. 18, 2022, doi: 10.1002/adma.202109550.
- [2] C. Du, Y. Wang, and Z. Kang, "Auxetic Kirigami Metamaterials upon Large Stretching," *ACS applied Materials & Interfaces*, vol. 15, no. 15, pp. 19190–19198, 2023, doi: 10.1021/acsami.3c00946.
- [3] N. An, A. G. Domel, J. Zhou, A. Rafsanjani, and K. Bertoldi, "Programmable Hierarchical Kirigami," *Advanced Functional Materials*, vol. 30 no. 6, 2020, pp. 1-9, doi: 10.1002/adfm.201906711