NSF: FND: COLLAB A Foundational Approach to Muscle Actuators that Lowers Barriers to Muscle-Powered Robotics Research

Award #1830403 | Michael Yip, University of California San Diego, and Robert Wood, Harvard University

Challenge with Artificial Muscles

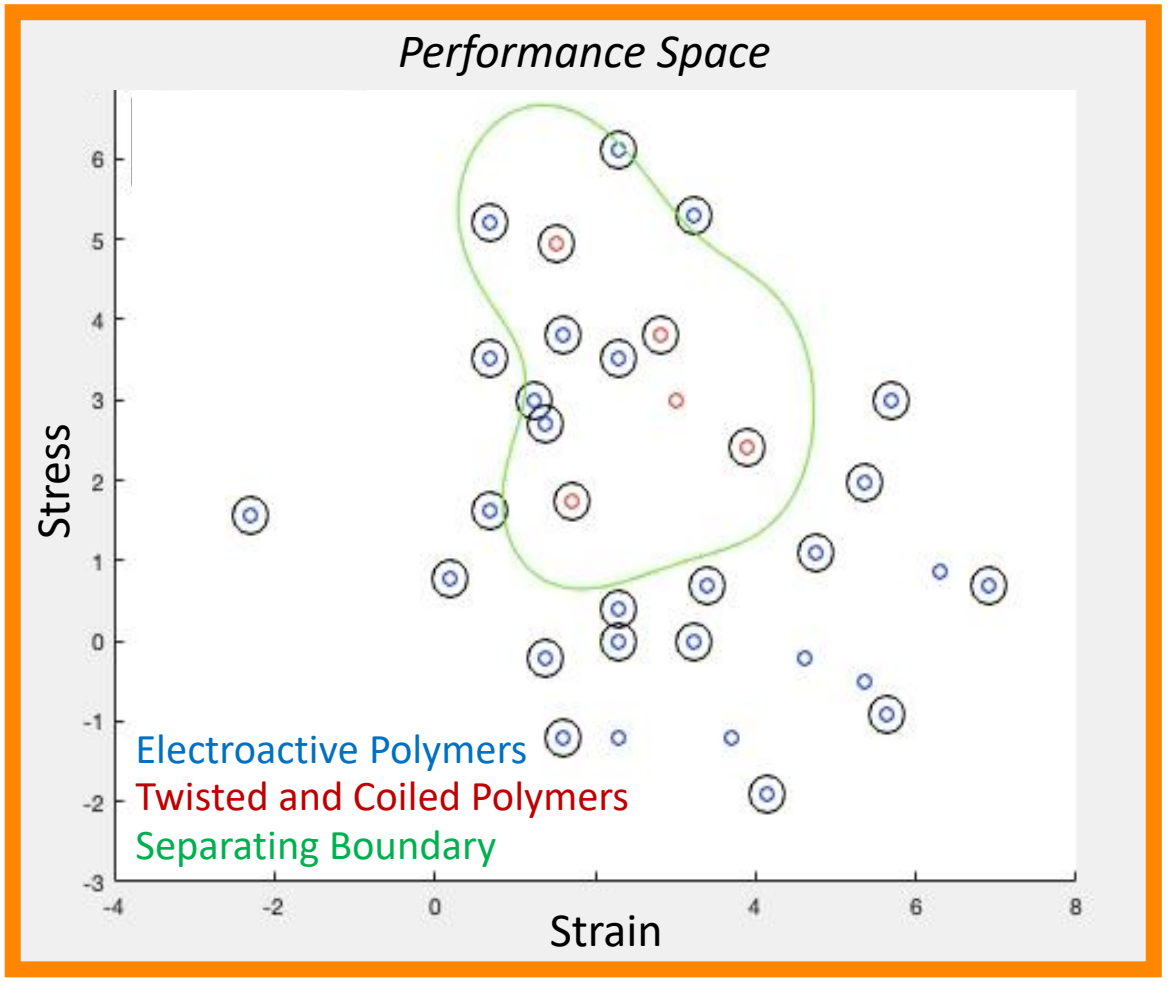
- Fantastic properties are promised, but in reality…
  - Esoteric physics
  - Nonlinear, hysteretic control
  - Large ramp-up to forming and fabricating actuator

Approach:

Lower Barriers to Research by using data-driven models for design and control.

Key Innovations (1)

- Describe a **Configuration Space** and **Performance Space** that all actuators can be compared equally in.
- Data-driven **Gaussian Mixture Models (GMMs)** and **Support Vector Machines (SVMs)** for muscle selection.
- **Combed publications**, inputting data.



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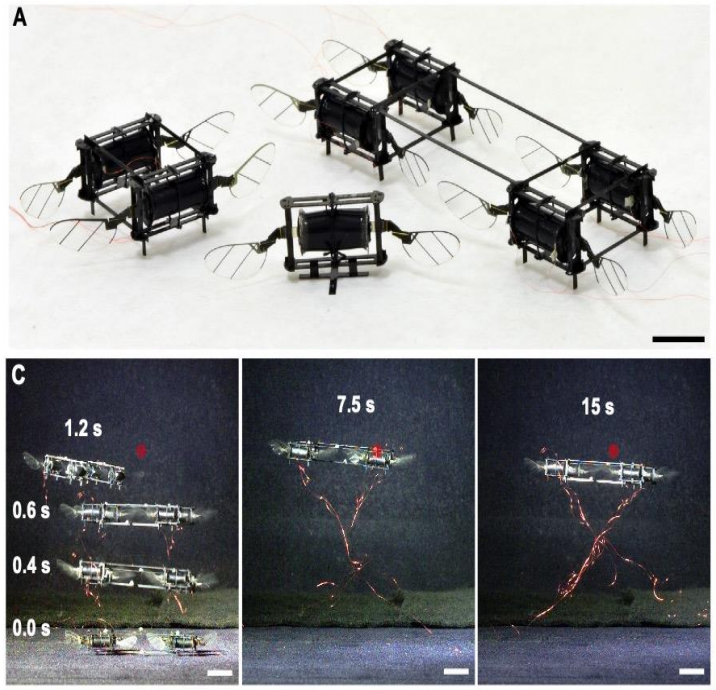
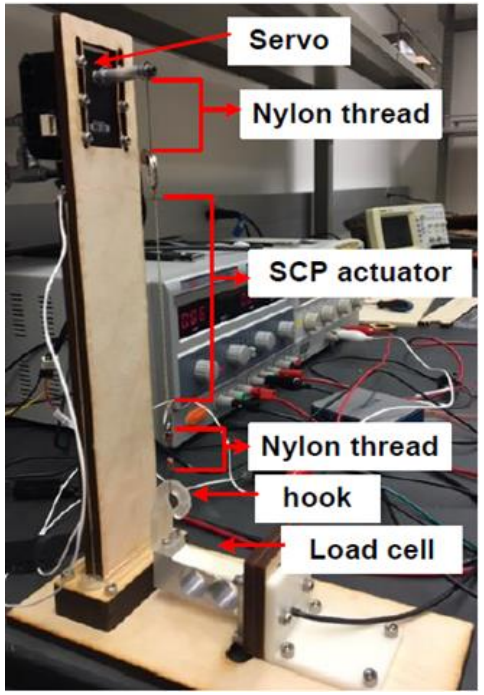
Key Innovations (2)

- **Using models for predicting muscle parameters.**
- **Explored new micro-DEAs** to for small-scale actuation.





Broader Impact

- **Interactive website** for collecting data, comparing muscle performance, choosing muscles.
- **Reach K-12 students** through a pilot version of the muscles toolkit

Scientific Impact

Presenting a new modeling strategy in performance and configuration spaces using data

Leveraging statistically relevant modeling, and enables straightforward muscle selection and design for robots