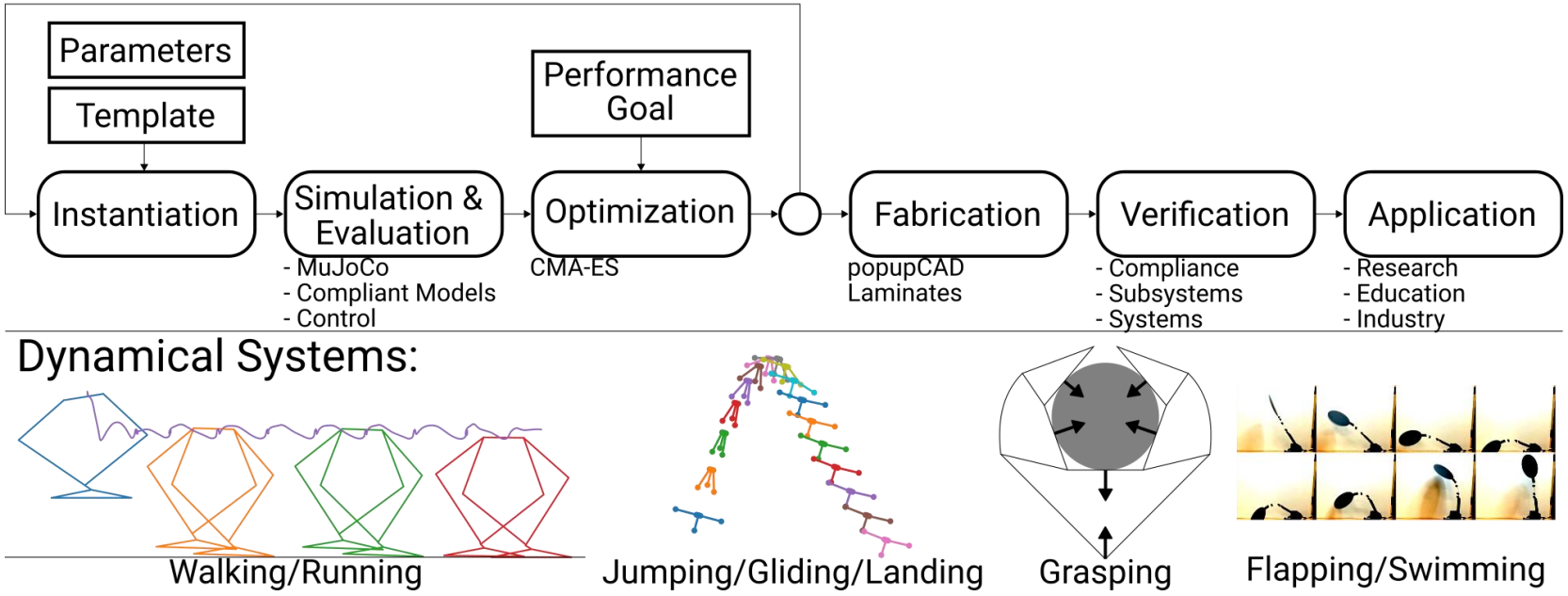
CAREER: Dynamic Modeling and Fabrication of Compliant Material Systems for On-Demand Specialist Robots

Award Number: 1944789
Funding Org: CMMI



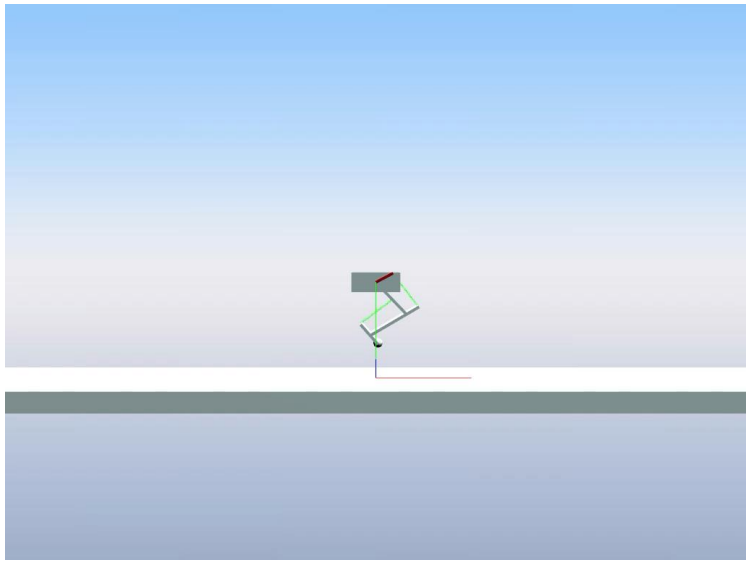
Challenge

- Lack of access to design and development pipeline for robotics
- Taking compliance and other nonideal behaviors into account during the design and optimization process.
- The time and cost limitations of physical prototyping are directed towards only a few variants of the physical platform.
- This results in limited use and applicability outside the field of robotics.

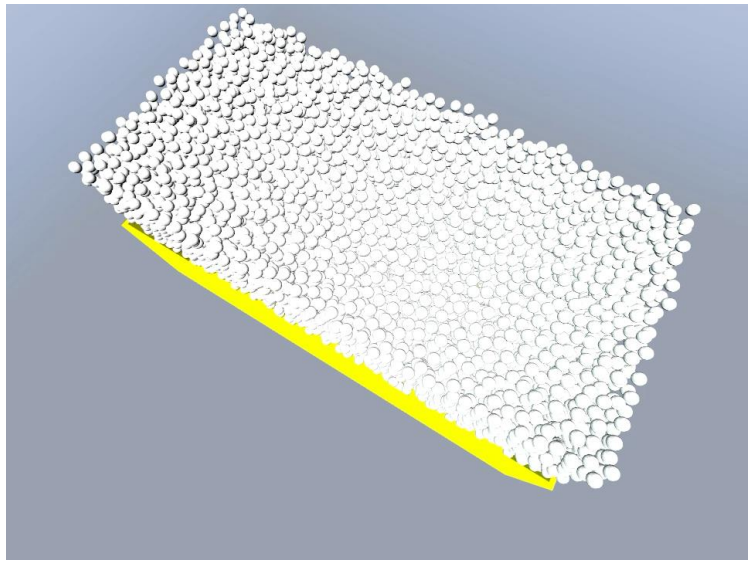
Approach

- Research Objectives:
  - representation of compliance
  - utilization and understanding of compliance
  - optimization of compliant systems,
  - validation through exemplar workflows and use cases

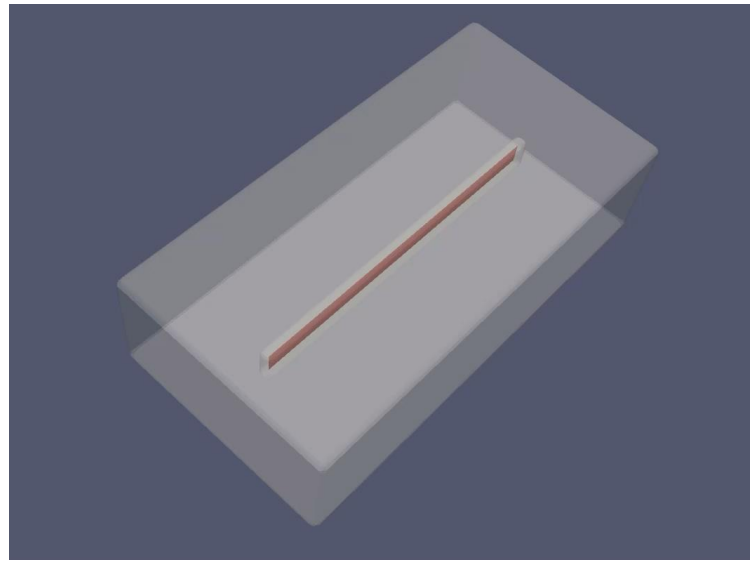
Multiphysics simulation of laminate devices interacting with different media



Rigid bodies with contact

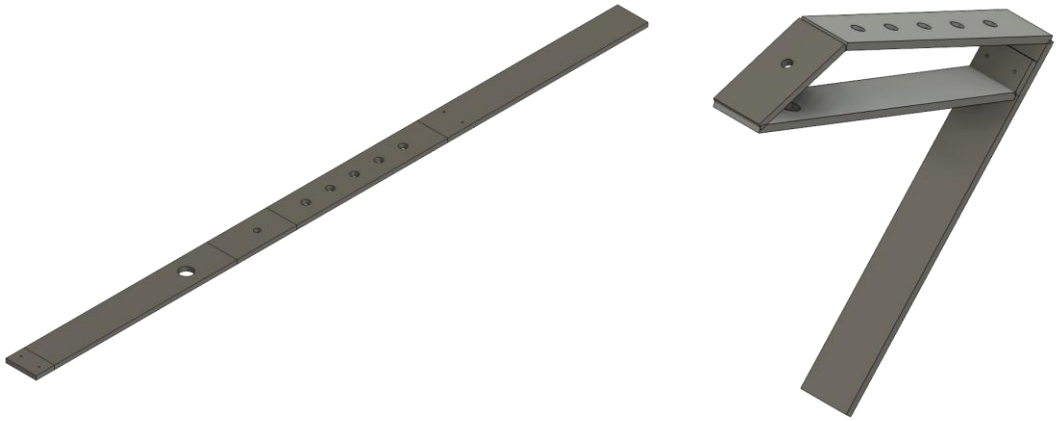


Granular material with FEA beam

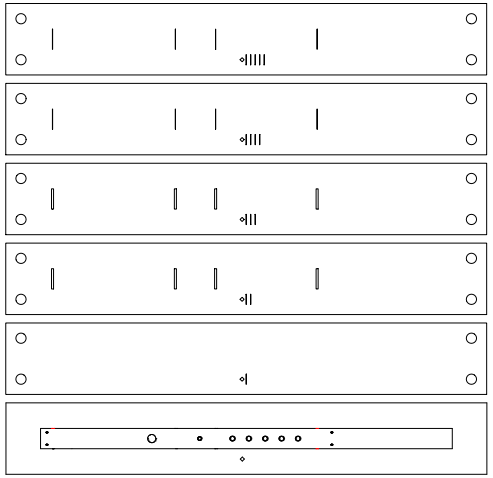


Fluid with FEA beam

CAD tools for laminate devices to enable accessible design and fast prototyping

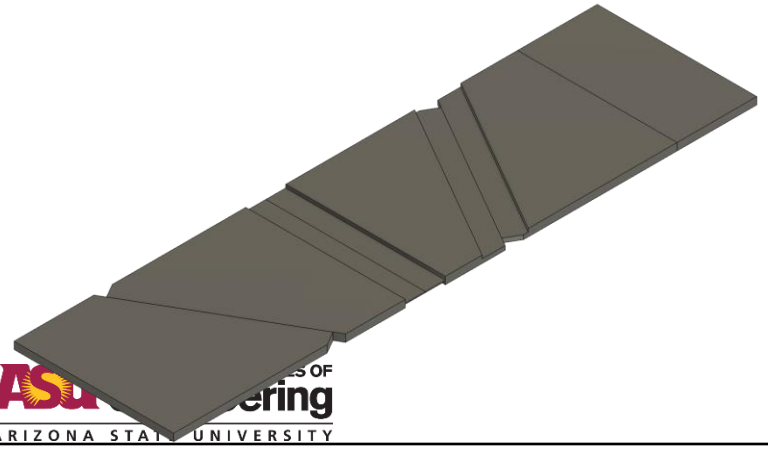


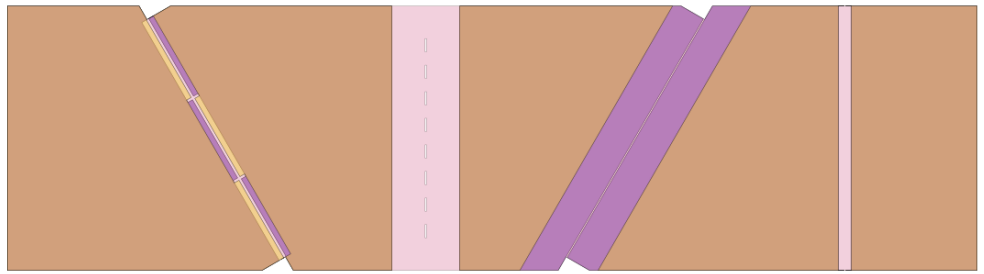
Design and validate in existing CAD software



Auto generate cut files

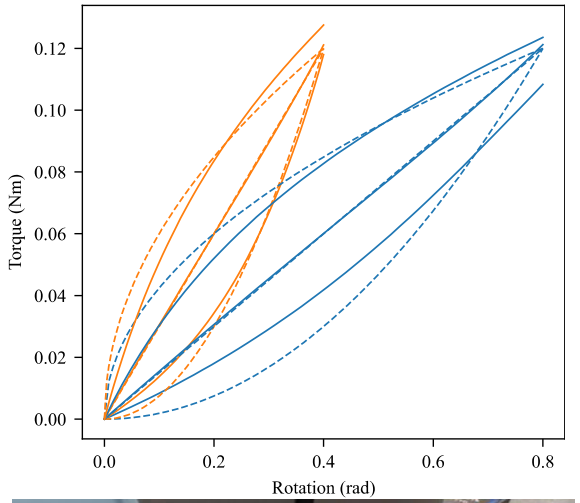
Fabricate and test

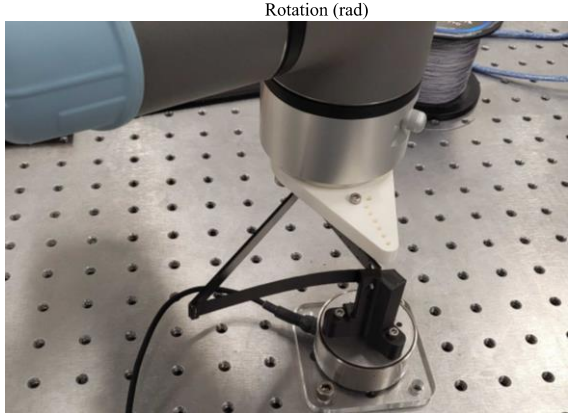


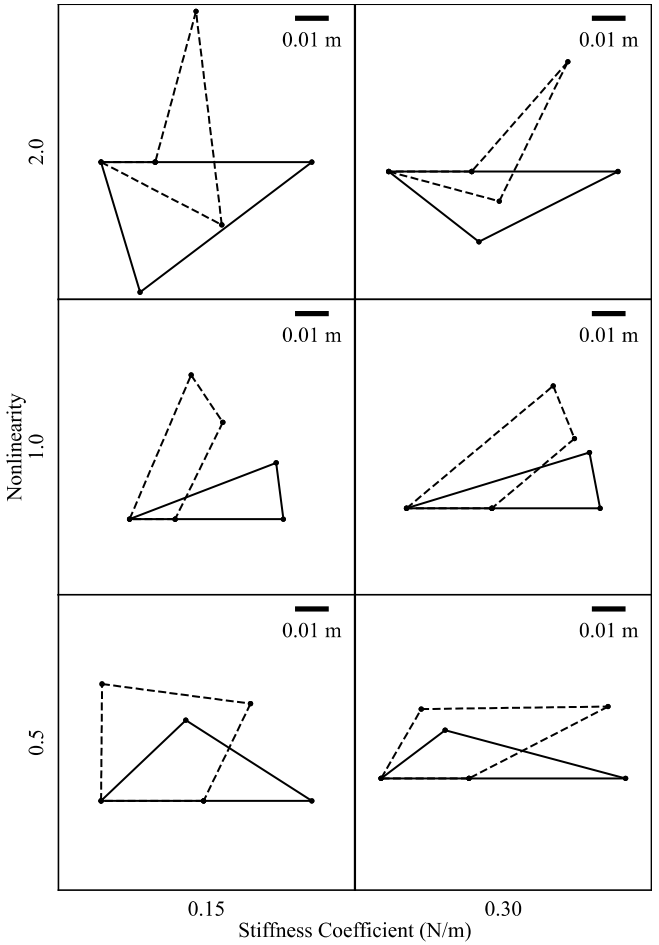


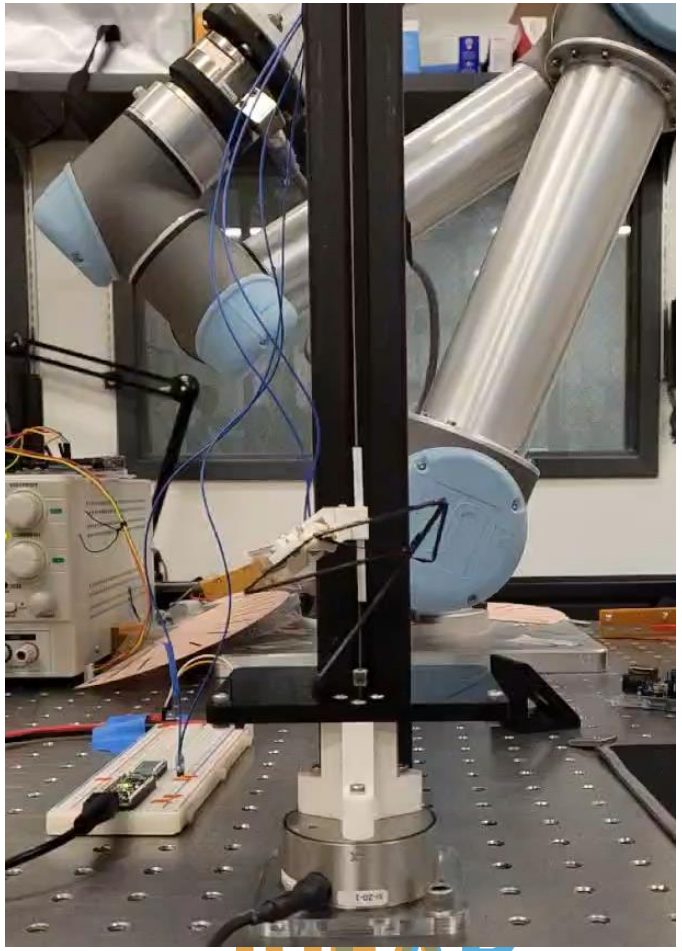
Customizable joint types and individual layer design freedom

Material characterization and compliance design for robotic tasks









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IDEAB

Scientific Impact

A unified robot modeling framework that supports the specialization and optimization of dynamical robots.

Broader Impact

Applications For Public Benefit

- Assistive robots for the elderly
- custom agricultural applications
- trash pickup in smart cities
- Warehouse automation

Education

- Integration into graduate and undergraduate curriculum
- STEM-focused robotics summer camp
- Collaboration with external evaluators to measure students' impressions of STEM