MAE263F Project Proposal

Modeling a Soft Modular Adaptive Robotic Technology (SMART) Arm

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Background

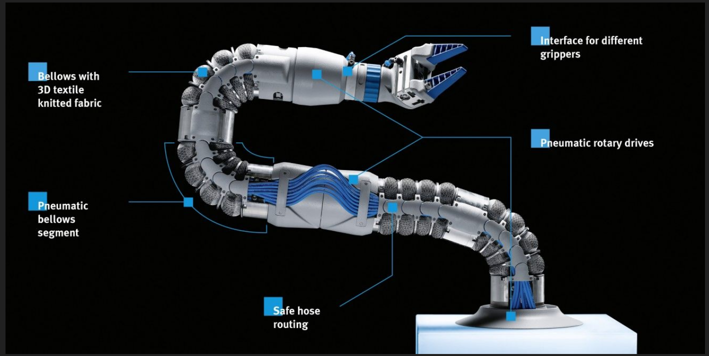
Rigid Robotic Arms

- Fixed joints locations and stiffness
- Rigid structures
- Limiting adaptability
- Limited workspace
- Safety hazard during human-robot collaboration

KUKA robotic arm

Soft Robotic Arms

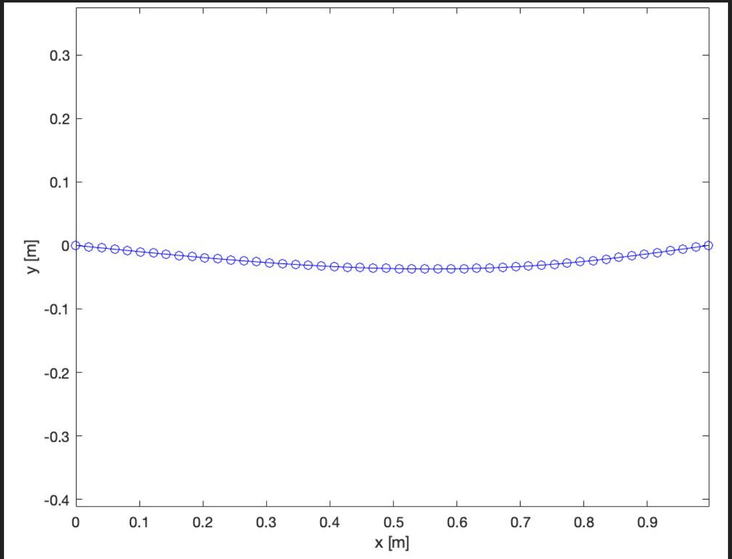
- Flexible materials
- Dynamic structures enhance versatility
- Dynamic joint locations
- Increased safety in unpredictable environments
- Increased adaptability, functionality, and workspace



Bionic SoftArm

Simulation

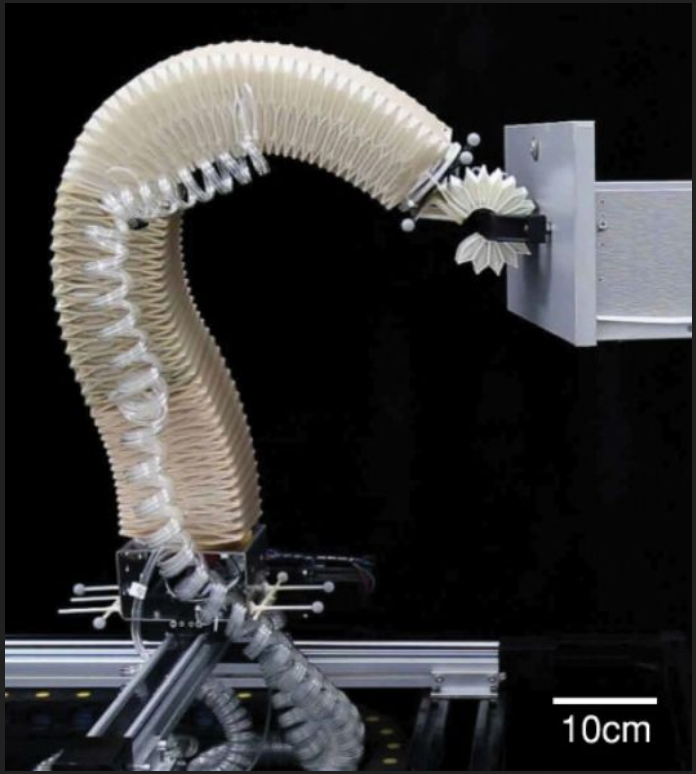
- **Objective:** Maximize workspace, adaptability, and configuration potential
- **Simulation Framework Architecture:** Dynamic beam bending problem
- **Variable Stiffness Implementation:** Each node has an adjustable stiffness and location
- **Actuation Mechanism:** Simulate forces at each module/link (edge)



Hypothetical Physical Representation

Pneumatic, hydraulic, dielectric elastomer, shape memory alloy/polymer, and fibrous actuation

- Dynamic link length
    - Joint location
- Variable joint stiffness
    - Second Moment of Area
- Node count



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