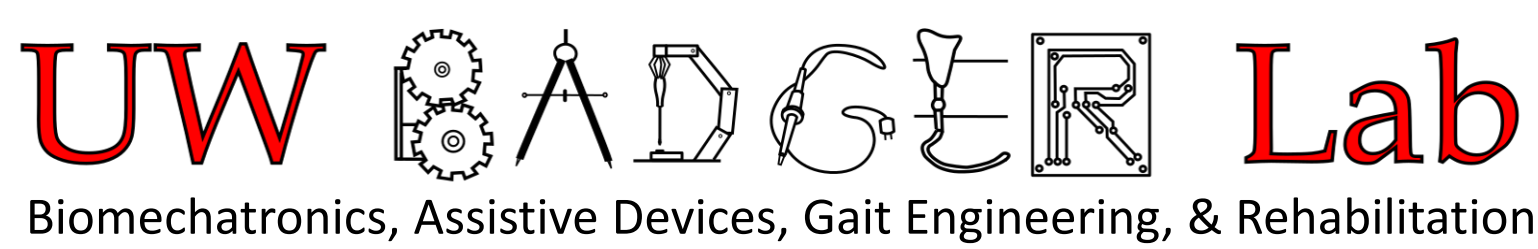


Hybrid Active-Passive Actuation For Human-Robot Collaboration and Rehabilitation



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PhD Students: Patrick Dills
Alex Dawson-Elli



Human-Interactive Robotics

- Safe
- Strong
- High-Performance

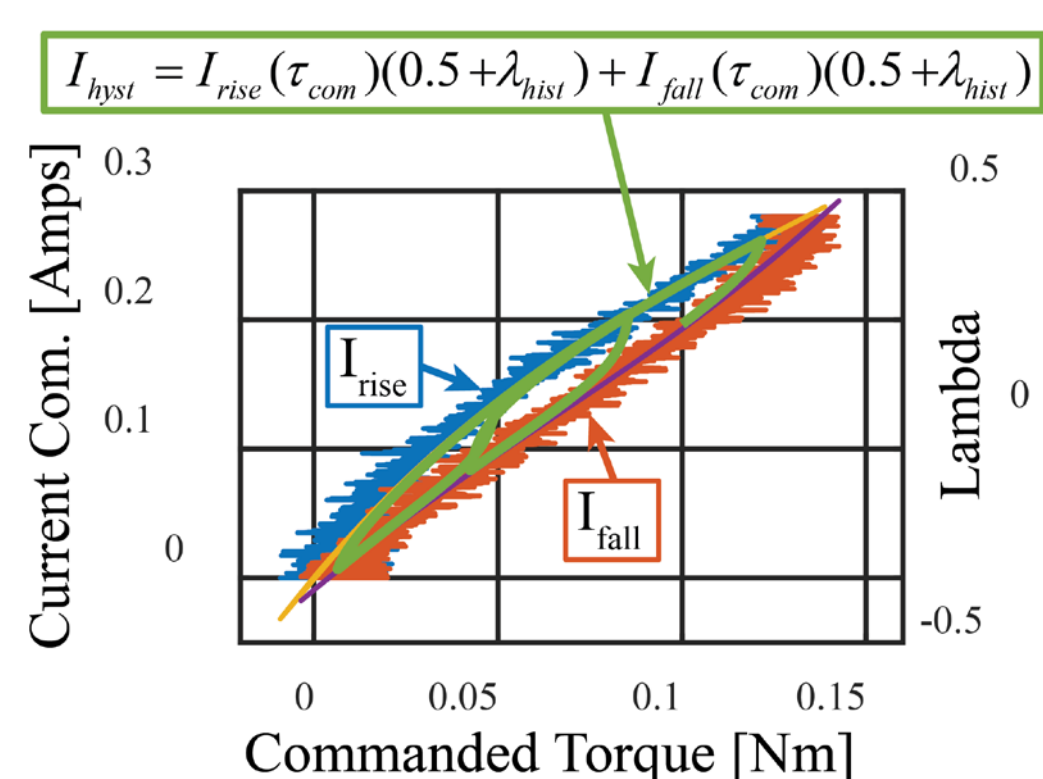
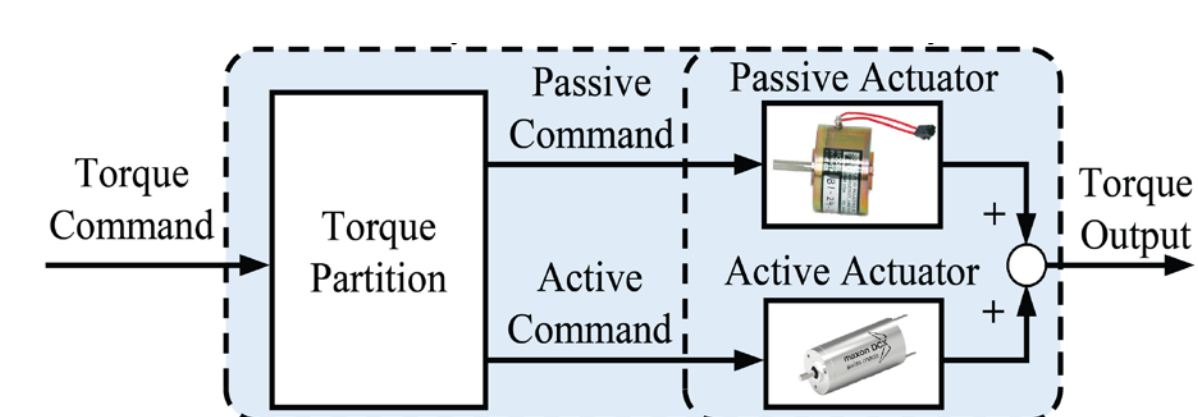


Objectives:

- Low Active Output Impedance (Safe to Humans)
- High Passive Output Impedance (Stiff to Humans)
- High Force Bandwidth (Accurate Haptic Fields)

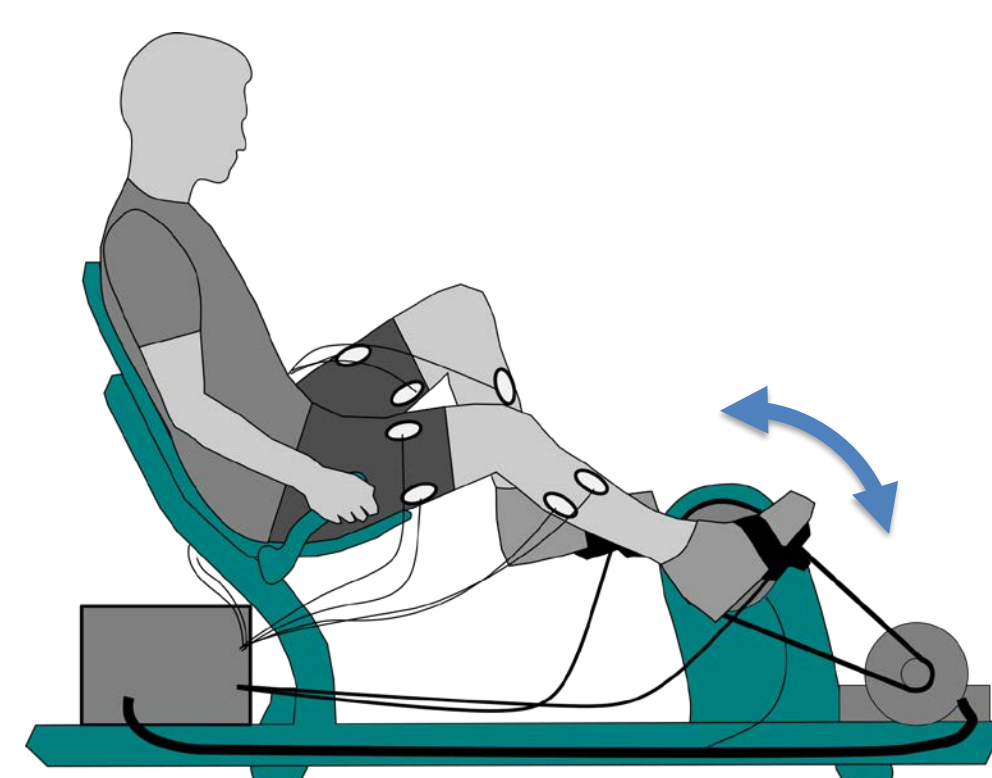
Challenges

- Balancing Active & Passive Components
- Nonlinear Brakes/Dampers
- Torque Partitioning



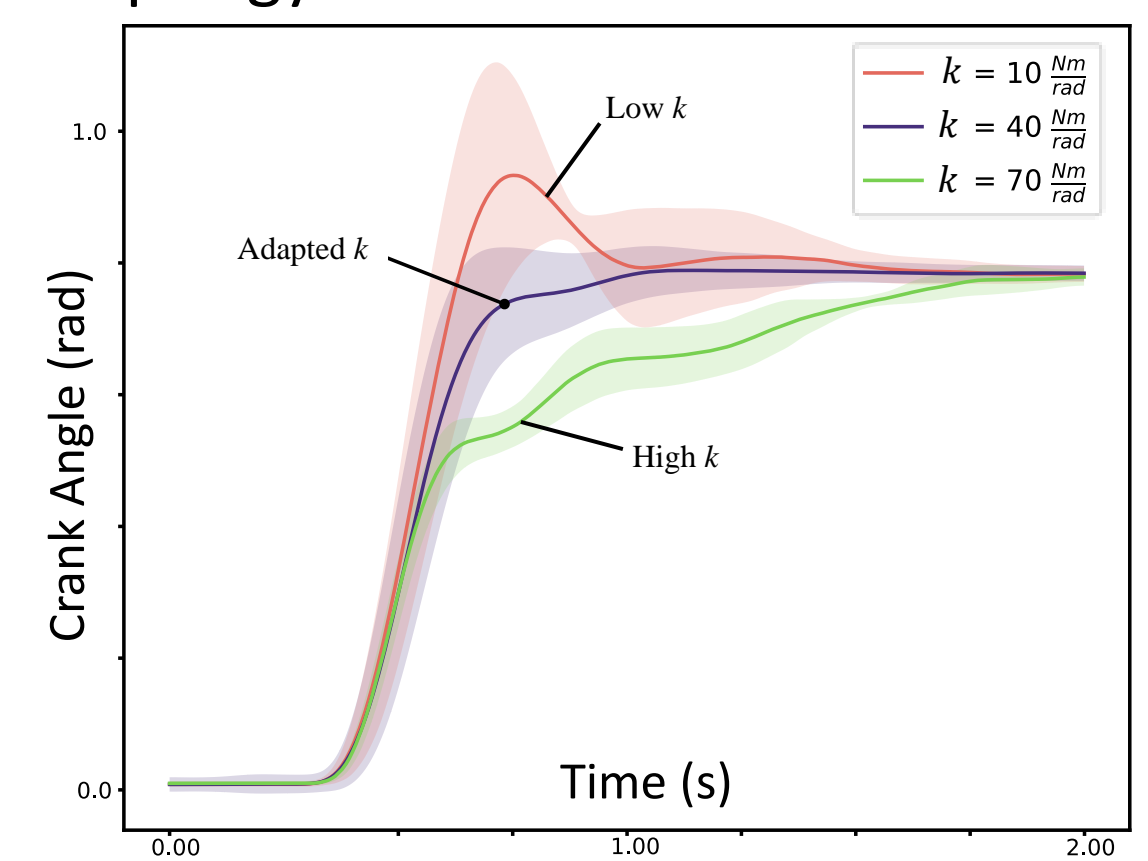
Key Arenas

Rehabilitation • Co-Manipulation • Haptics



Haptic Leg-Reaching with NOTTABIKE

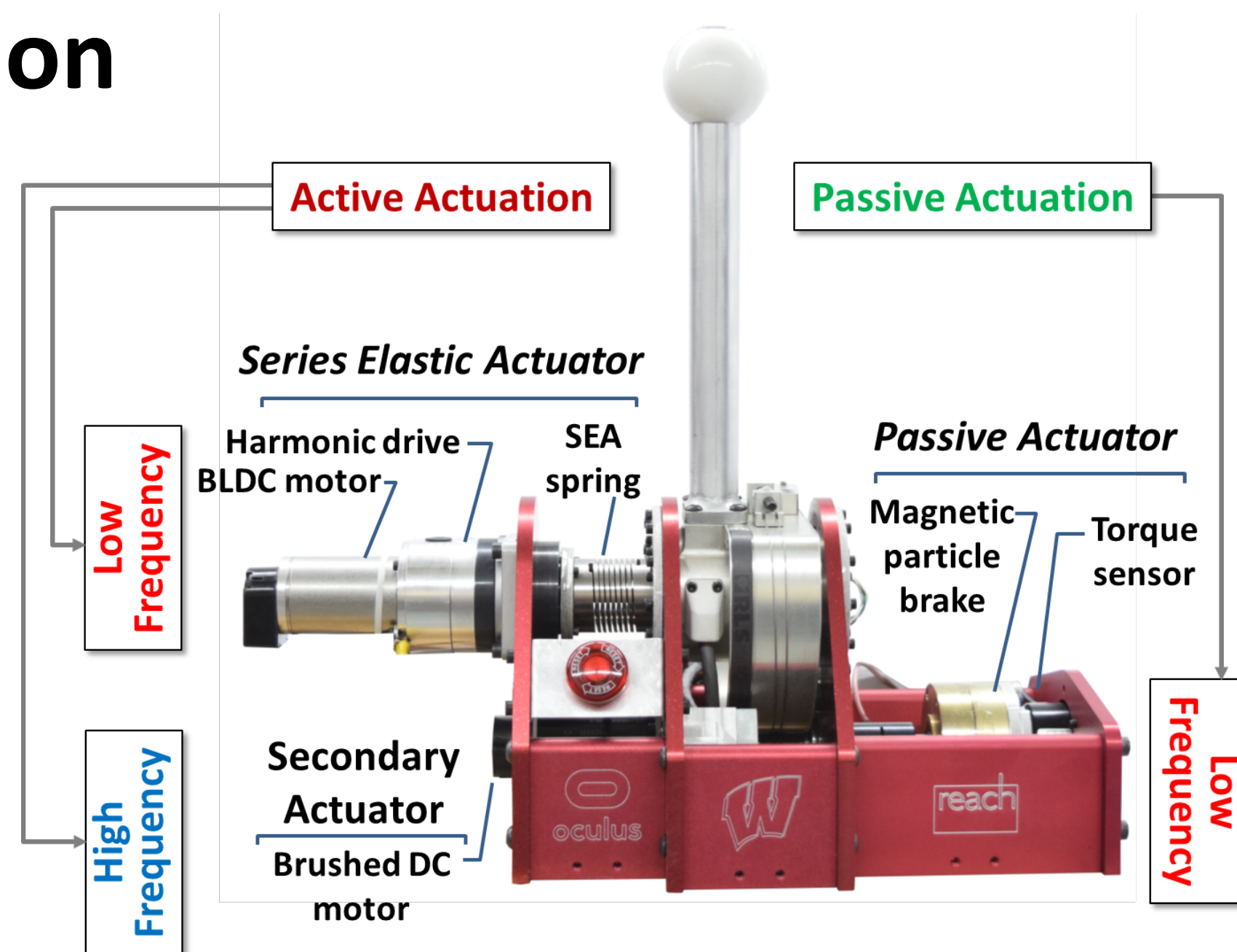
Springy Force Field and Catch Trials



Hybrid Active-Passive Actuation

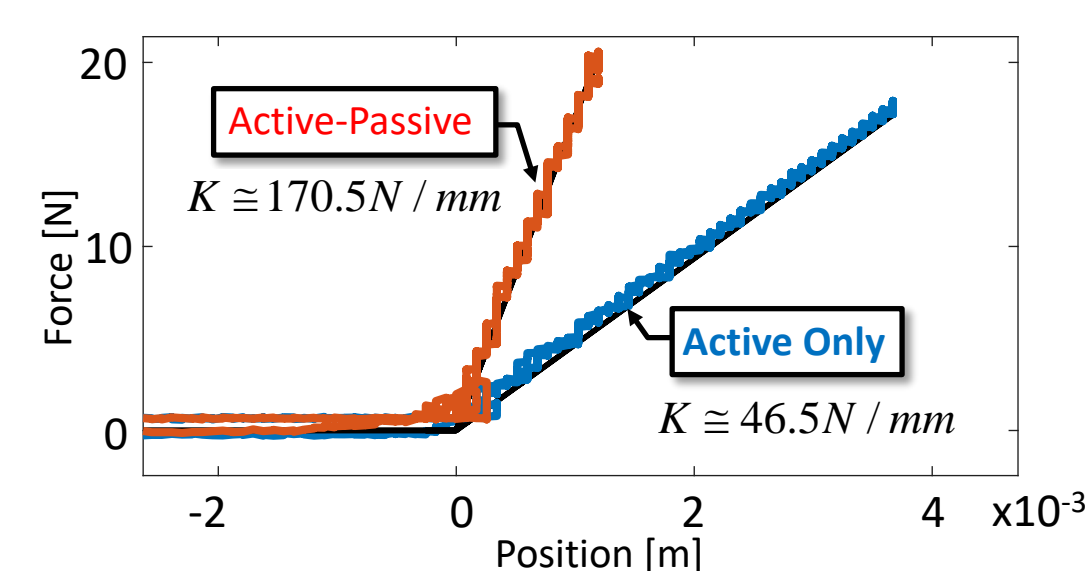
Actuator Architecture:

- SEA – Low Output Impedance
- Direct-Drive – High Bandwidth
- Brake – Stiffness, Dissipation

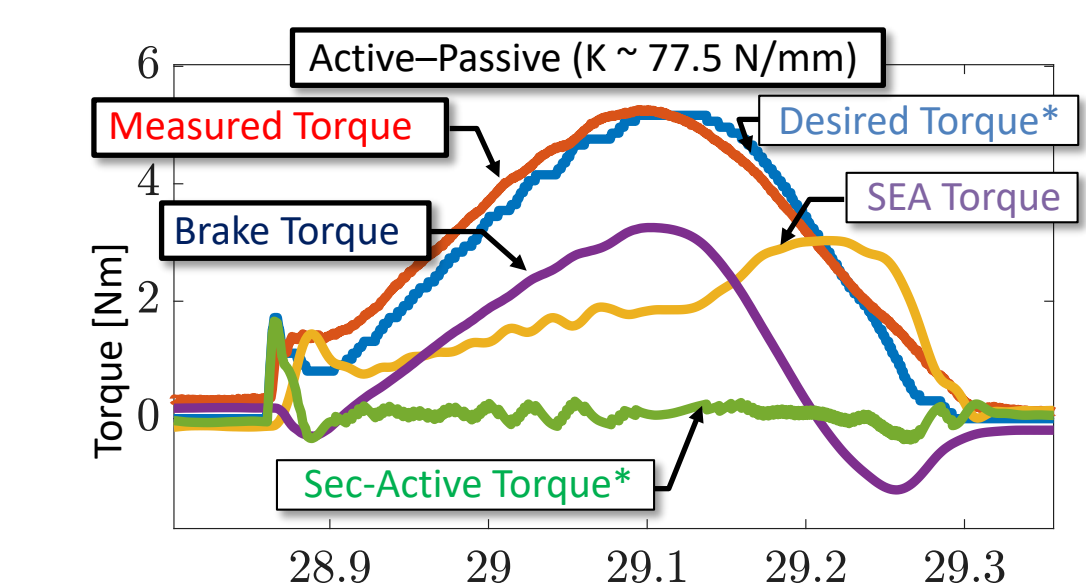


Accomplishments

Stiffer Virtual Walls:



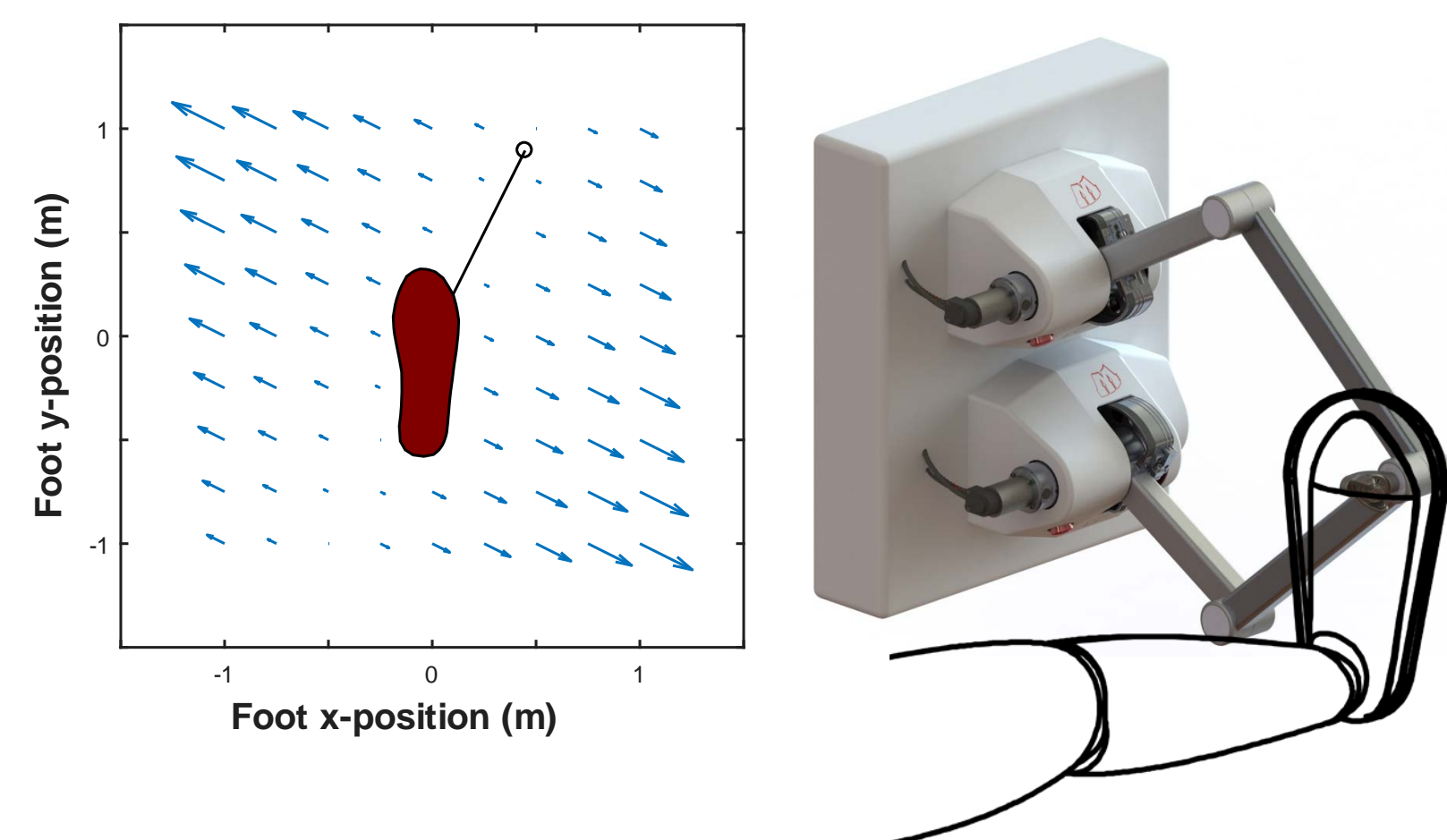
Torque Partitioning:



Impact: Application

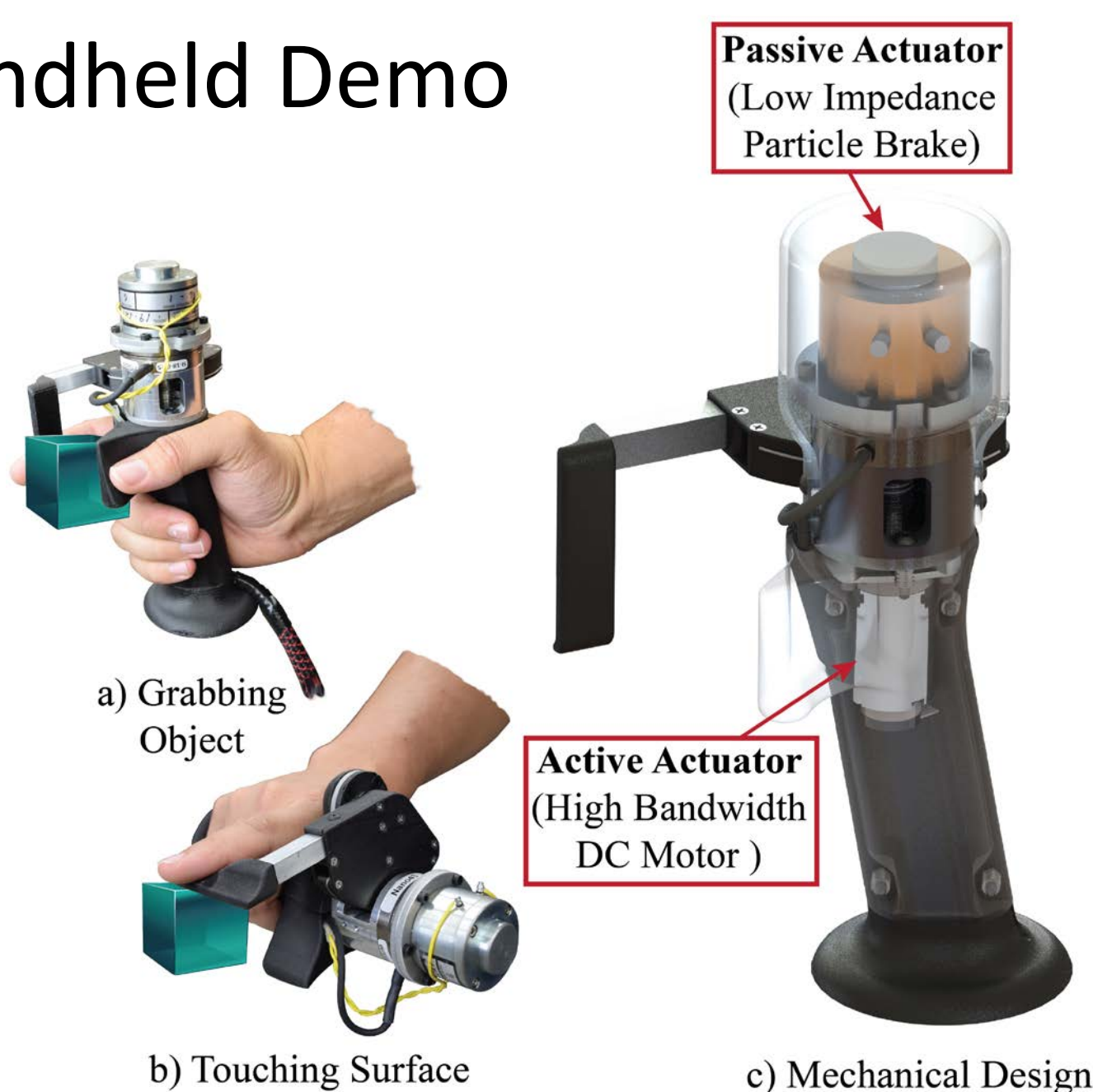
Rehabilitation • Motor Control

2 DOF Leg Reaching Rehab Robot



Impact: Education

Handheld Demo



Impact: Science & Technology

Actuators • Control Partitioning

