

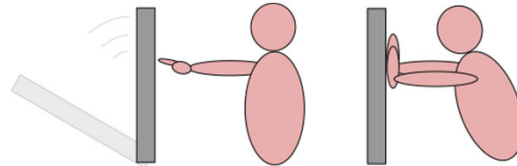
Hybrid Active-Passive Actuation For Human-Robot Collaboration and Rehabilitation

PI's Peter Adamczyk, Michael Zinn, Kreg Gruben
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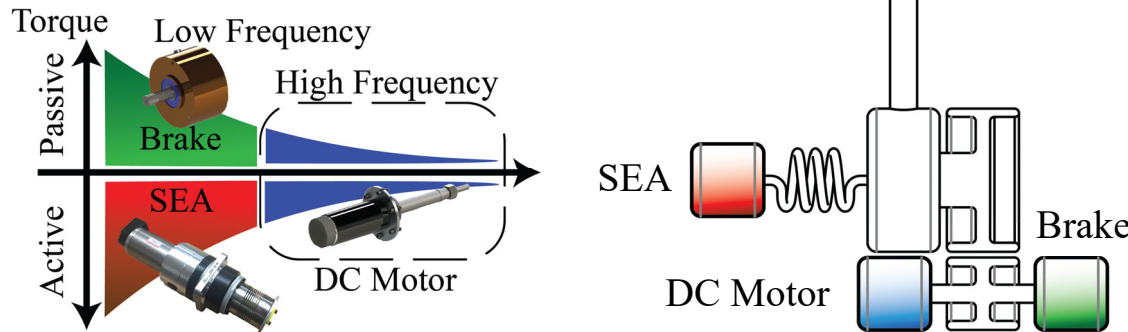


Safe Robots

- Active Output Impedance: Low
- Passive Output Impedance: High



Solution: Multiple Actuators



Scientific Impact

- Active-Passive partitioning in design and control
- Stiffer haptics, quicker movement

Broader Impact

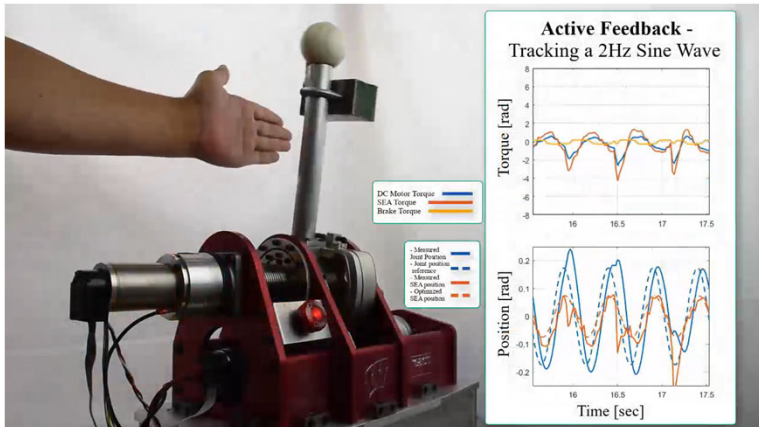
- Haptic Robotics
 - Motor Rehabilitation
 - Teleoperation, Training
- Safe Industrial Cobots
- Outreach: Education
 - How and why of Haptics



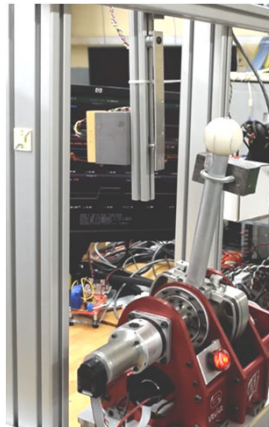
Handheld Haptic Demonstrator

Accomplishments To-Date

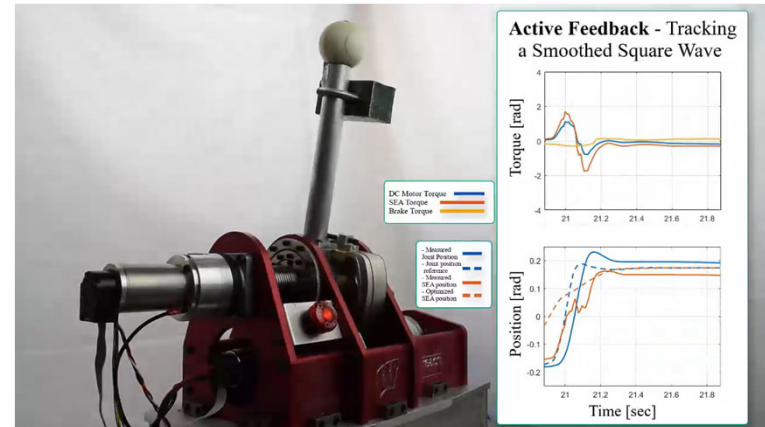
Benchtop Unit: Control Optimization



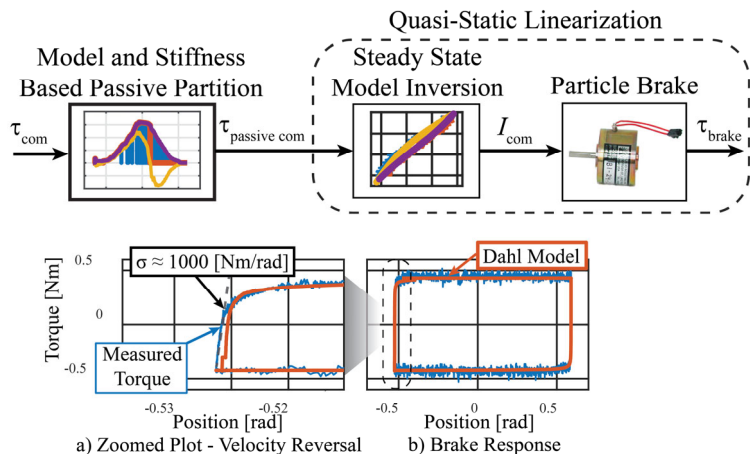
Impact Tests



Improved Servoing: Feedforward Control



Model-Based Control Optimization



Dahl friction model: Stiffness + Hysteresis

Design of 2-DOF High-Power Haptic Leg Robot



100 Nm Hybrid Actuator

Optimal Force and Workspace Matching

