NRI: FND: Controllable Compliance: A New Robotic Arm for Contact-Rich Manipulation

Peter Whitney and Robert Platt

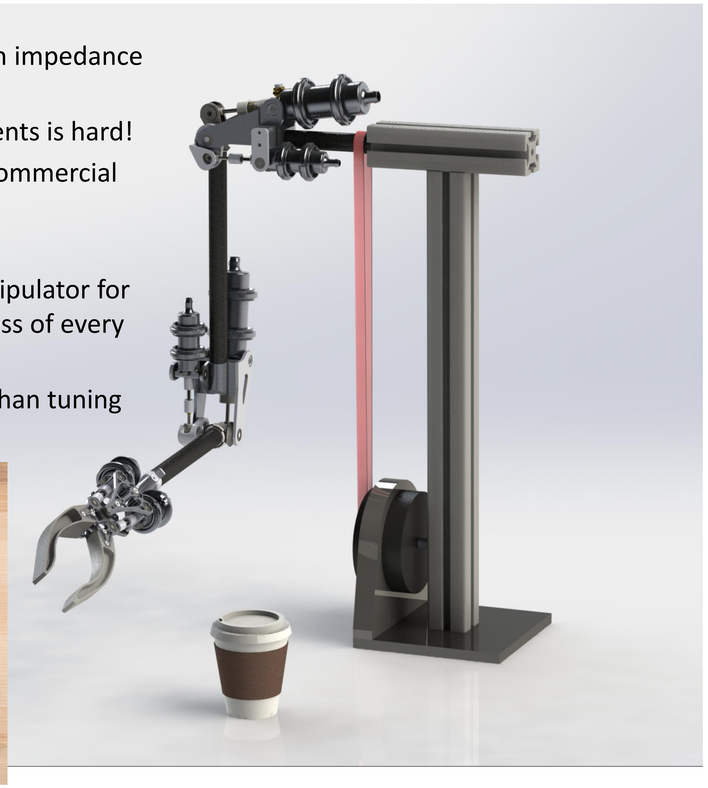
Northeastern University

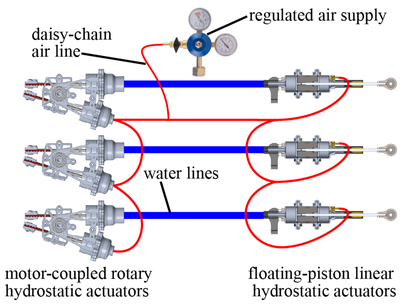
Challenges:

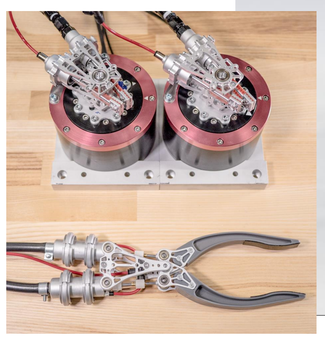
- Building a lightweight arm capable of active high-bandwidth impedance control is hard!
- Controlling contact-rich interactions in uncertain environments is hard!
- Meeting cost and performance demands for assistive and commercial markets is hard!

Aims:

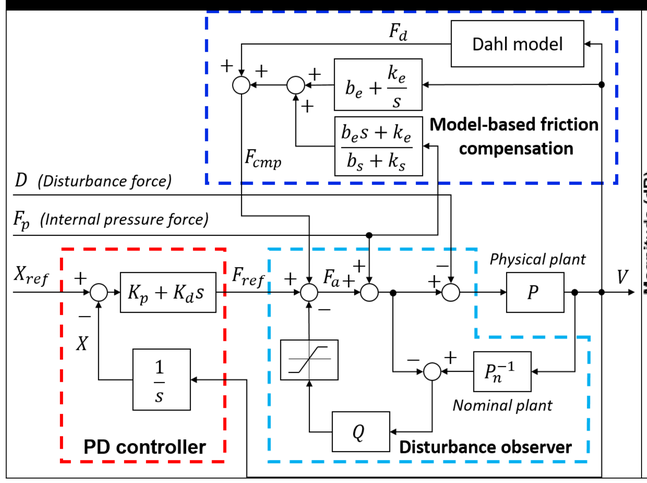
- Developing a lightweight, low-impedance 7-DOF robot manipulator for research and mass production, capable of tuning the stiffness of every joint over a wide range
- Developing process for learning optimal controllers rather than tuning controllers for specific hardware



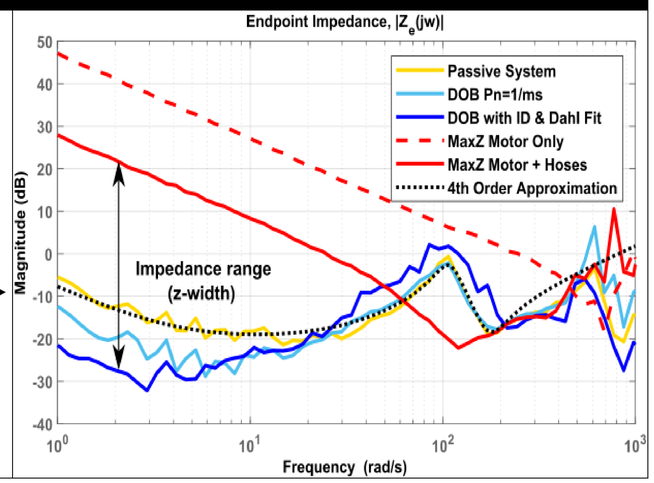




Control Block Diagram



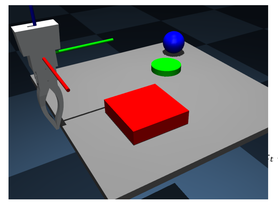
Endpoint Gripper Performance

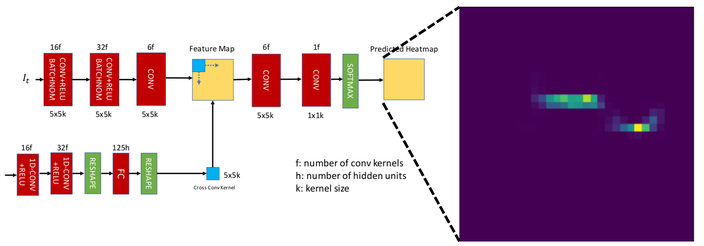


Localization Using Tactile Data

The Helping Hands Lab

robotics collaborative



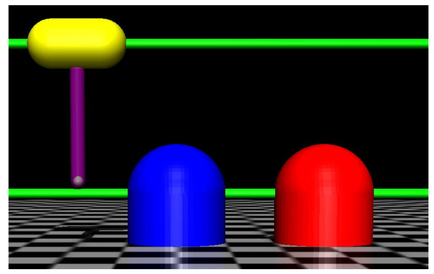


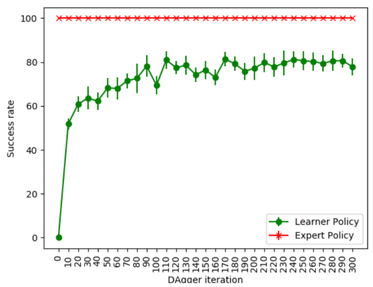
Problem:

Localize finger tip using:

- Initial single coarse depth image
- Continuous finger force measurement

Force Feedback "Terrain Following"



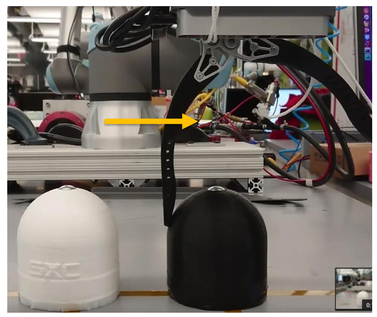


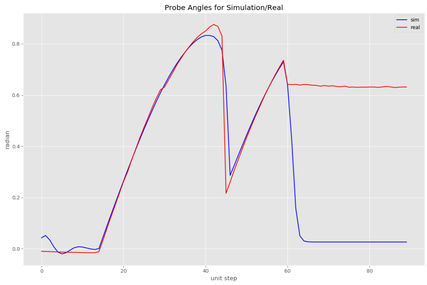
Problem:

Push the red bump to the right without moving the blue bump

- **Force feedback only** (no vision)
- DAgger active learning

2-DOF gripper attached to UR-5 robot arm, swipes finger left-to-right





2020 National Robotics Initiative (NRI) Principal Investigators' Meeting

FEBRUARY 27 - 28, 2020 | ARLINGTON, VIRGINIA