NRI: FND: COLLAB: An Open-Source Robotic Leg Platform that Lowers the Barrier for Advanced Prosthetics Research

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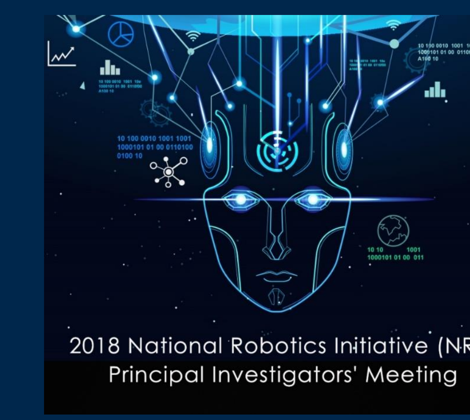


Introduction

Motivation

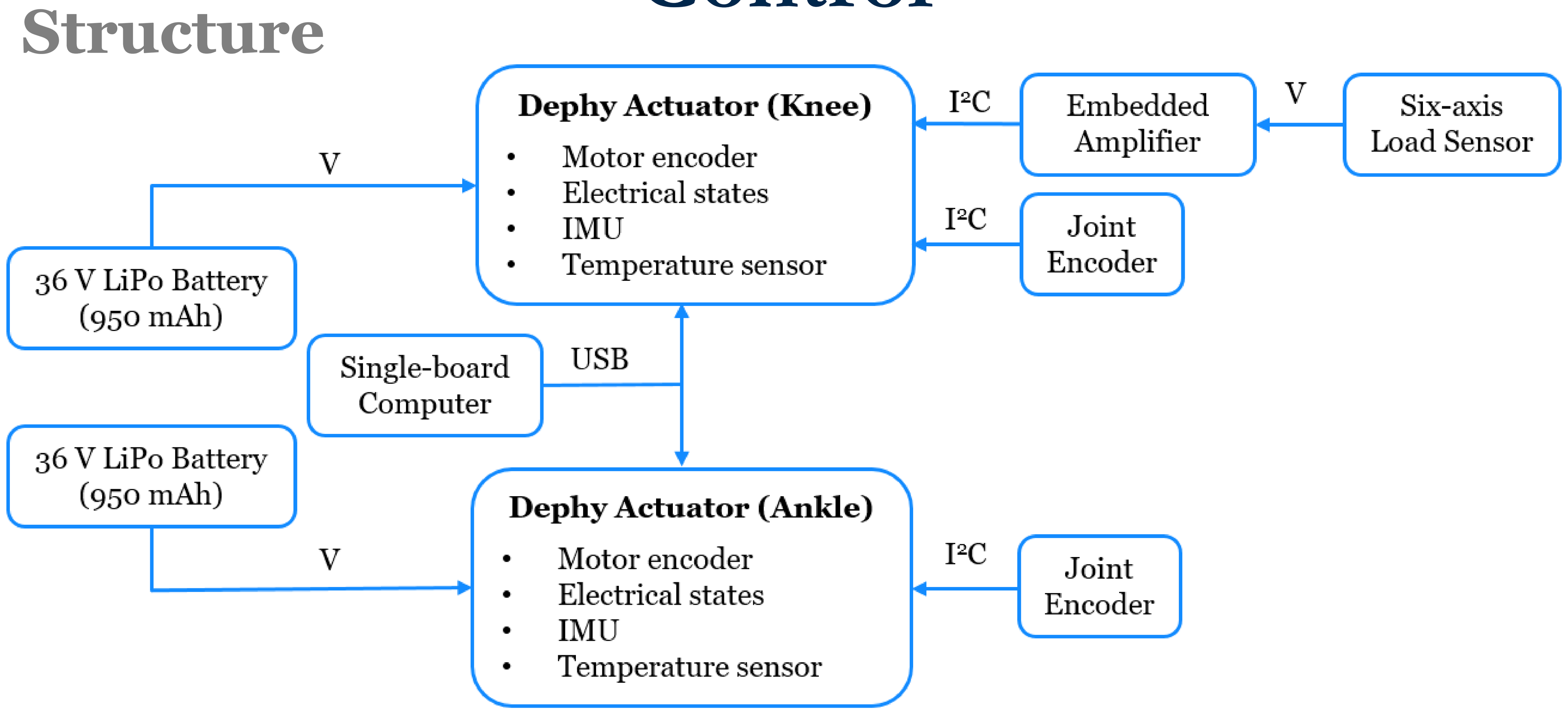
- Many researchers in prosthesis control and developing robotic legs
- Difficult to compare results across platforms
- Substantial investment of time and resources

Goal

- Common hardware platform for control comparison
- Lower the barrier to entry
- Study in the lab, community, and at home

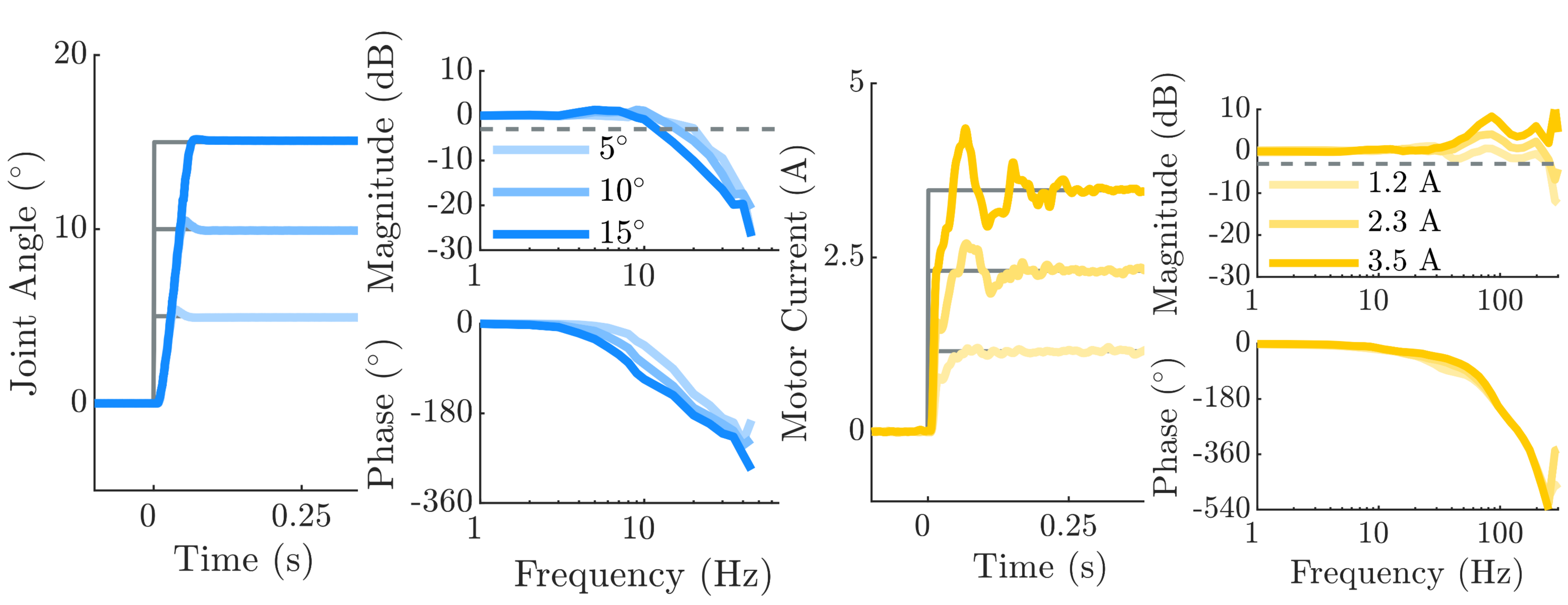
Control

Structure



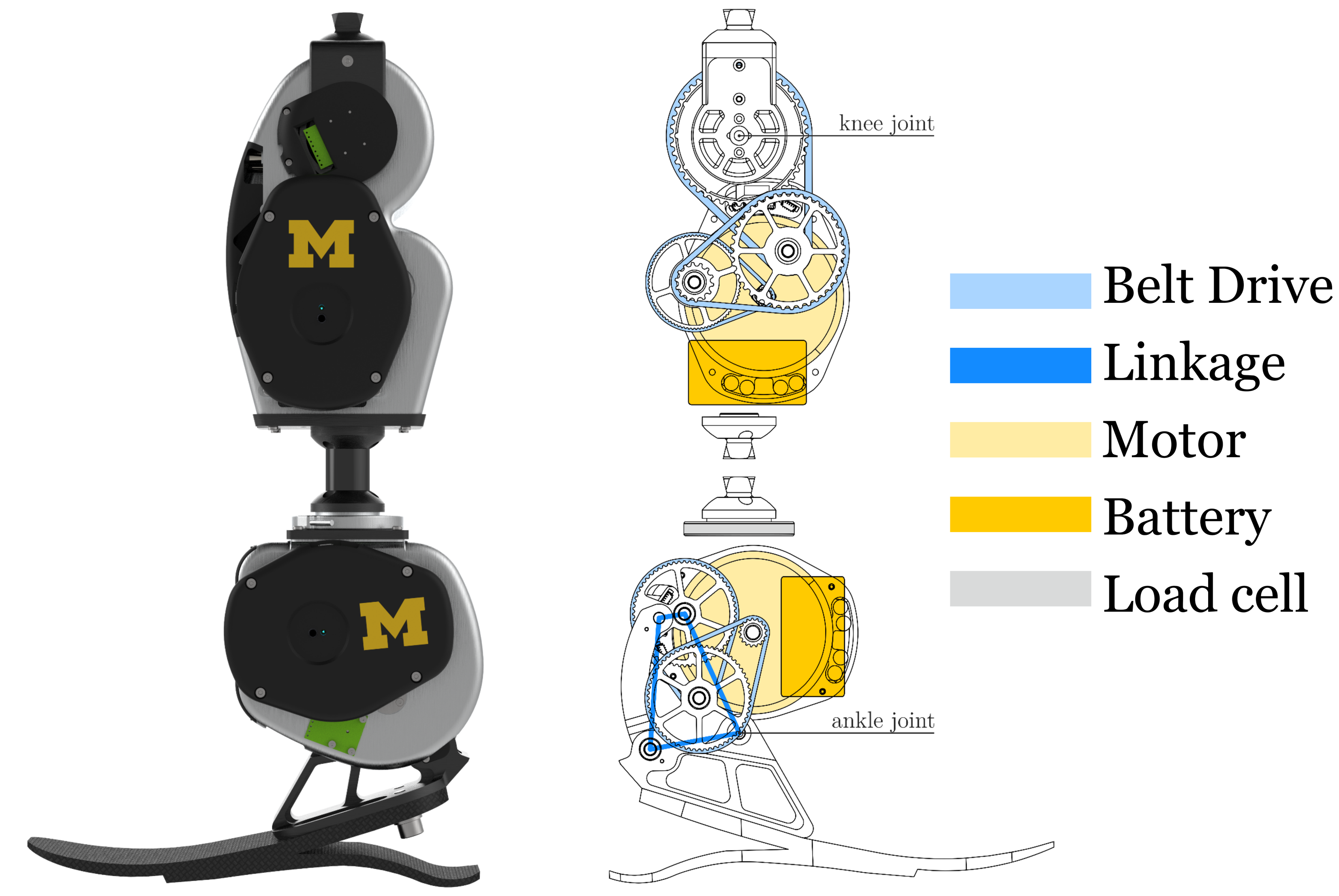
- **Low Level:** Current and position loops local to drive
- **High Level:** Open source Python API with range of communication bus options (USB shown)

Performance



- **Position Control:** Rise time: 25 ms, Bandwidth: 10-20 Hz
- **Current Control**: Rise time: 29 ms, Bandwidth: >200 Hz

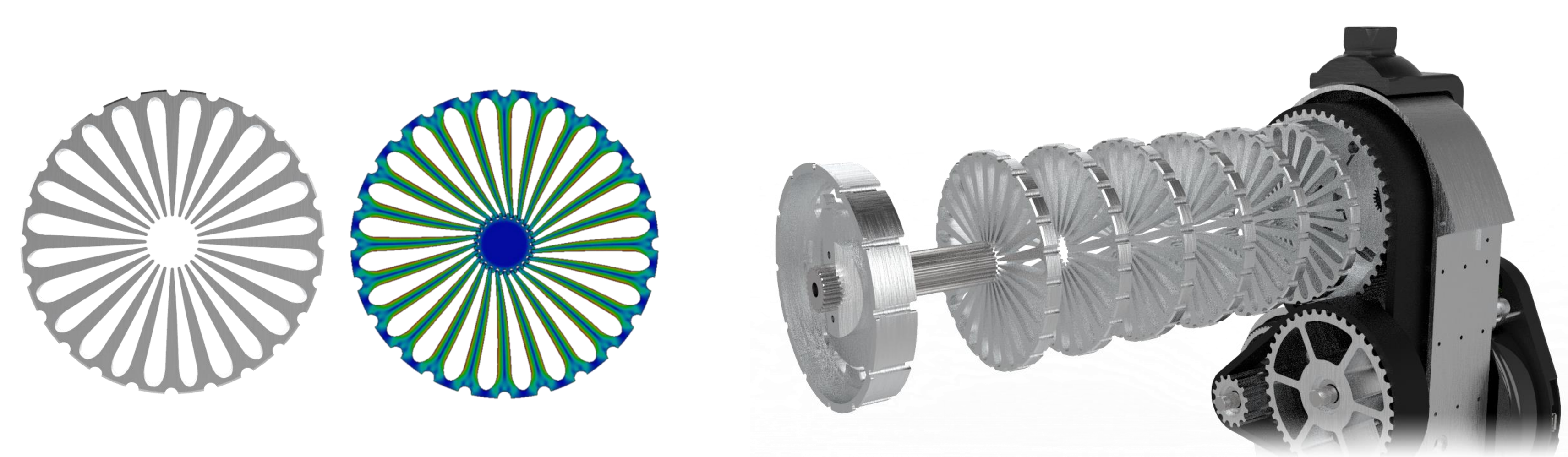
Design



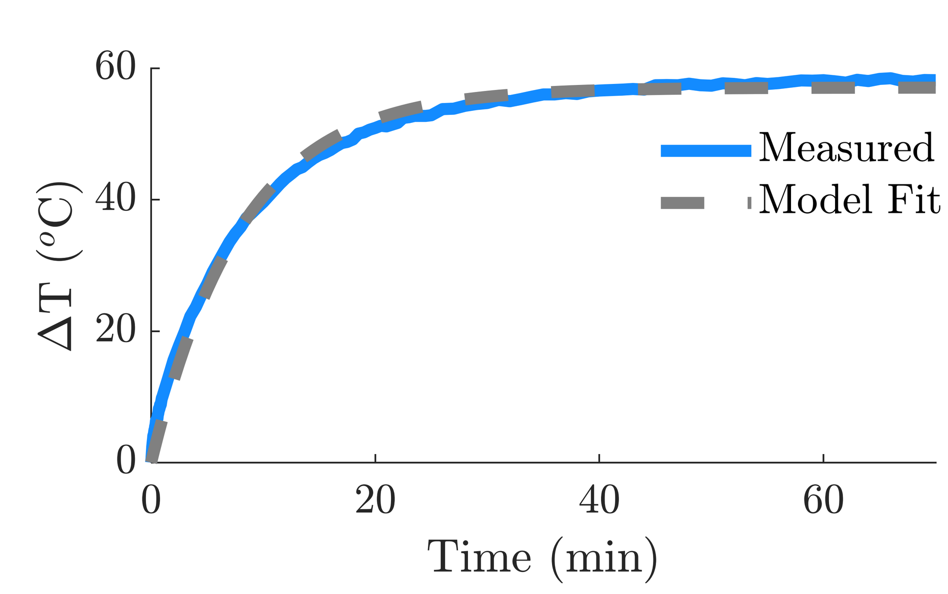
- Modular 2 DOF knee-ankle prosthesis
- **Mass:** Knee: 2300 g, Ankle: 1700 g
- **Transmission Ratios:** ~50:1

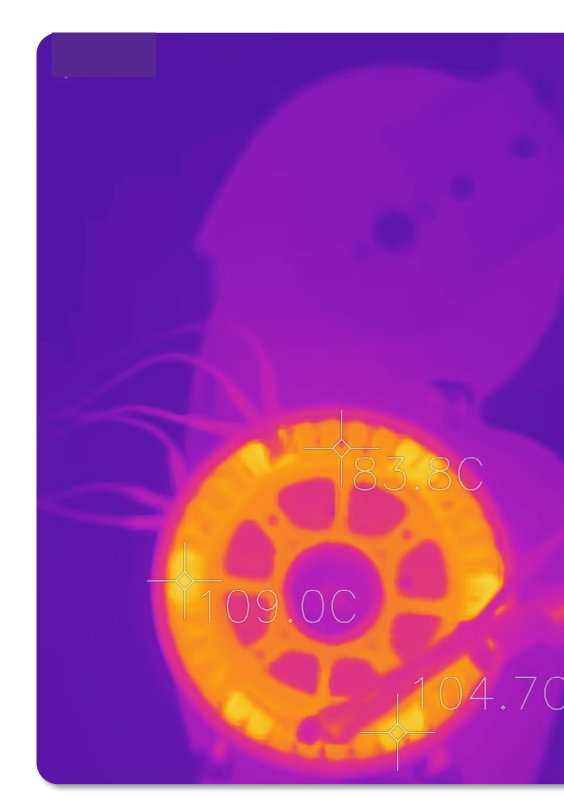
Selectable Series Elasticity

- Custom torsional spring disks: k = ~100 Nm/rad
- 0-6 spring disks can be stacked inside knee output pulley



Thermal Modeling

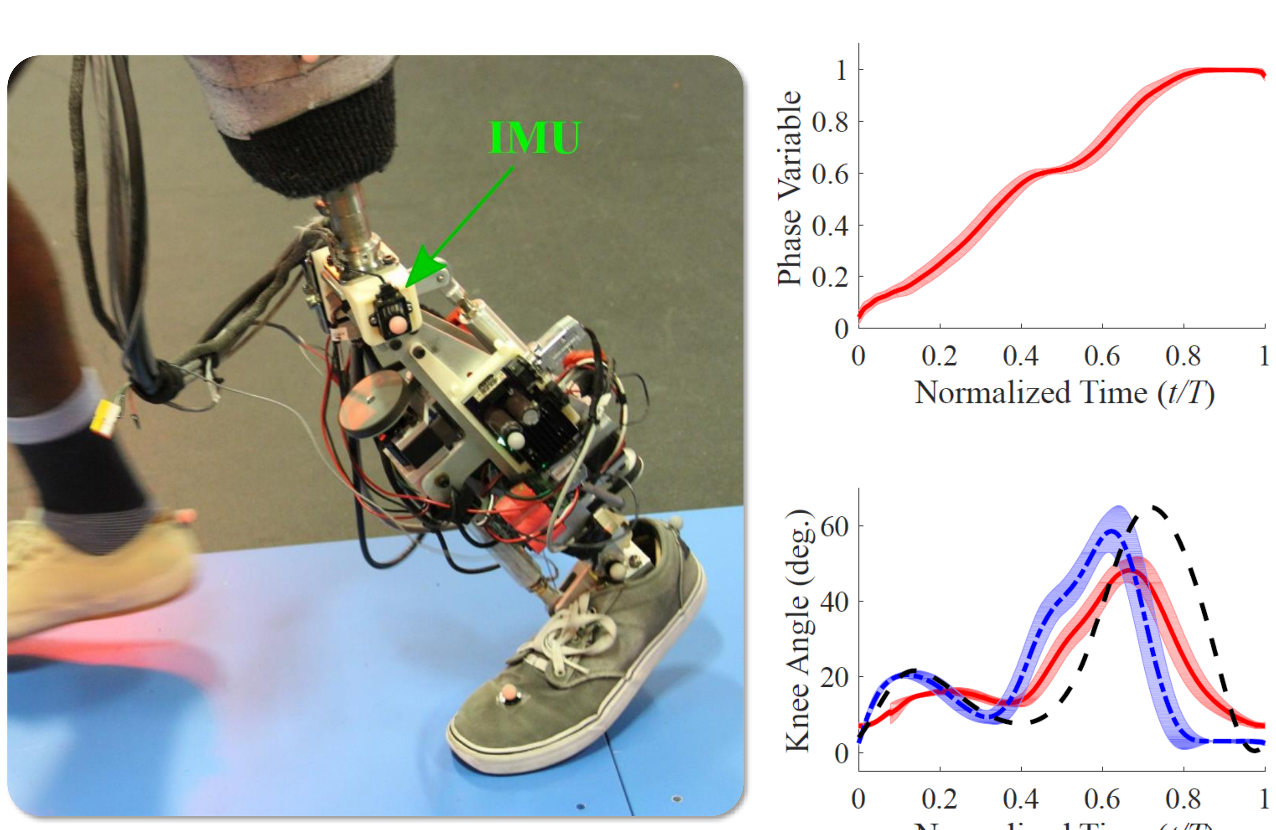




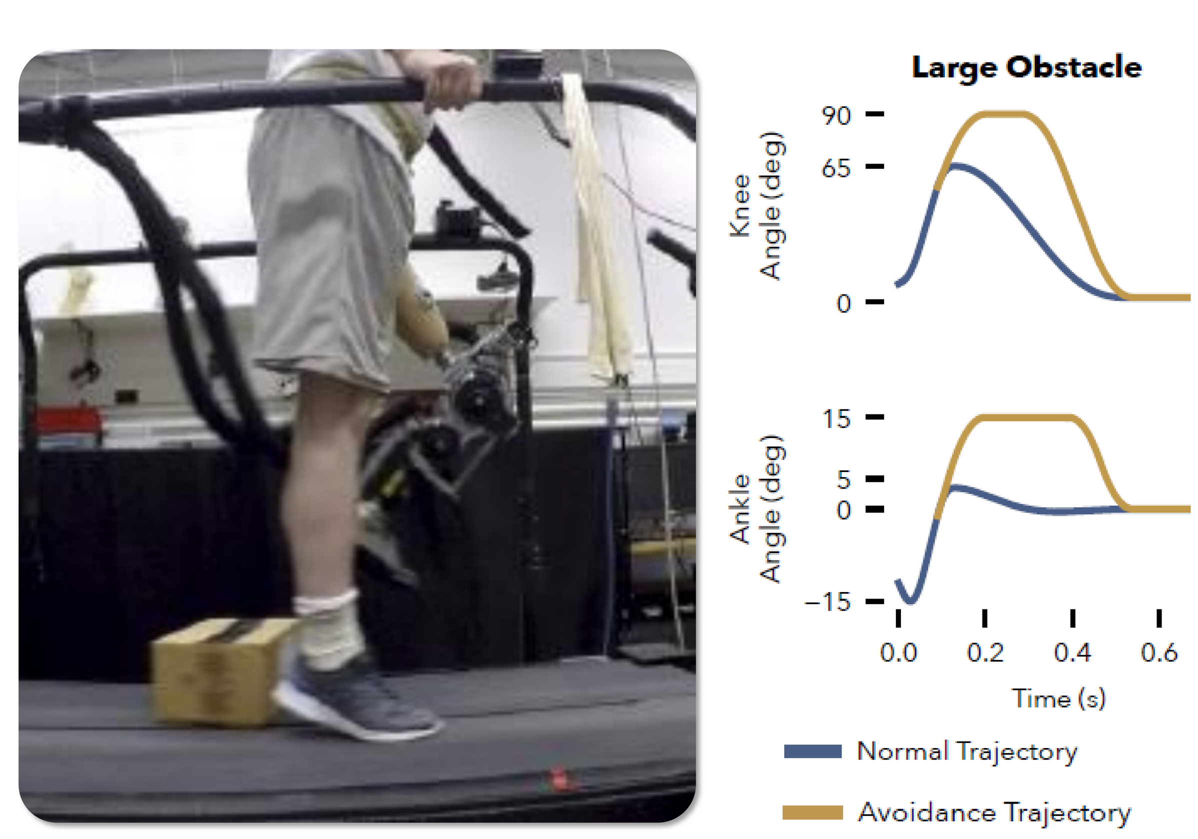
- **Thermal Resistance:** 3.9 °K/W
- **Thermal Time Constant:** 486 s

Future Work: Comparison of Control Strategies

UTD Phase Based Control



CMU Reflex / Stumble Recovery



NU / AbiltyLab Intent Recognition

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