Collaborative Research: NRI: INT:

# An Open-Source Framework for Continuous Torque Control of Intuitive Robotic Prosthetic Legs



# Open Source Leg (OSL)





#### Conventional Approach to Prosthetic Leg Control



#### **OSL** Series Elastic Actuator



OSL adjustable spring assembly



Spring calibration showing stiffness corrupted by dynamic belt effects and backlash

## Torque Control





Torque controller accounting for OSL dynamics and series elastic actuator spring characterization

#### Continuous Control

- Continuous Phase Control
- Coordinated Movement Control

## Synchronization to the Residual Thigh Angle



IEEE Transactions on Robotics 2018 Patent pending

Real-Time Phase Variables



"volitional" control:
thigh angle → phase
 (switching logic)

"rhythmic" control: phase plane angle (no switching)

Forward Overground Walking [Passive]

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## Wearable Motion Capture





## Coordinated Full-Body Movement



#### Predict Appropriate Trajectories

