# Optimizing A Passive Assistive Device

## Team Member

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## Description

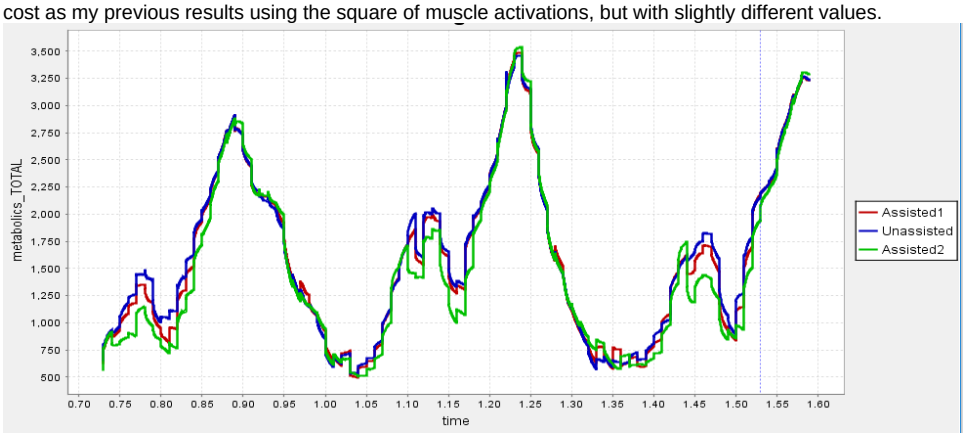
I have performed previous simulations in OpenSim using Computed Muscle Control (CMC) to show that a passive assistive device is effective at reducing metabolic cost when using the sum of muscle activations squared as a cost function. However, the stiffness and resting length of this device has not been optimized to maximize metabolic savings. In addition, these simulations were performed at one speed for one subject over one gait cycle and therefore could be much more computationally rigorous to determine how these parameters change across subjects and speeds. In addition, my previous simulations use CMC with the assumption that kinematics do not change with use of the device, but this assumption may not be valid. Therefore, it would be advantageous to test this assumption with kinematic data of a subject using the device. Using this data, CMC could then be used to determine how the muscle activations change throughout the gait cycle with the altered kinematics while wearing the device.

## Research Questions

1. What does the landscape of metabolic cost look like when resting length and stiffness are varied for a single subject? What are the optimal values for these parameters? How big of an effect do small variations in each of the parameters have on the metabolic savings?
2. Do these optimal stiffness and resting length parameters vary between subjects or are they approximately the same when normalized by subject height and weight? How does speed affect the parameters?
3. Do kinematics change significantly when using the device? If so, how does changing kinematics induced by the device change muscle activation during the gait cycle?

## Progress

- Set up MATLAB API for scripting
- Added a metabolic probe to my model and tested on a couple of stiffnesses and resting lengths. I saw the same trends of decreasing metabolic cost as my previous results using the square of muscle activations, but with slightly different values.

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