Recommendation Title: Develop Predictive Biomechanical Models of Human Movement

Recommendation Code: LF1A

Category: Limb/Whole Body, Function

Recommendation

Background and Relevance

Detailed musculoskeletal models and simulations have been useful in interpreting experimental data and providing insight into the biomechanics of human locomotion and quantities that are difficult to measure experimentally. In addition, such models can be used to assist in identifying appropriate clinical interventions. However, few models have the ability to predict the response of an individual patient to a specific intervention.

Thus, there is a need to develop patient specific simulations that can accurately predict human motion without knowing *a priori* what the motion will be. Such a simulation would be useful in predicting the effects of an impairment or intervention and allow for the optimization of intervention outcomes. In addition, such models would be extremely valuable in testing hypotheses regarding neuromotor control.

One of the primary challenges in developing predictive models and simulations of human movement is the lack of actuator control models. Most models have feed-forward controls, which makes them highly unstable with respect to perturbations to the system. Thus, testing of hypothetical interventions is very difficult.

Objectives
1) Develop a tool to predict the effectiveness of rehabilitation and surgical interventions.

Recommended Actions
1) Develop physics based predictive musculoskeletal models and evaluate various controllers.

2) Verify the accuracy of the model and simulation predictions when subjects undergo the same interventions using new or existing data.