Optimal Control Workshop

Time: July 9, 2015, 11 am – 6:30 pm

Venue: Paterson's Land, University of Edinburgh, Holyrood campus

Presenters: B.J. Fregly and Anil Rao, University of Florida

Inspired by Ton van den Bogert's keynote lecture two years ago, we cordially invite you to attend a workshop on the application of direct collocation optimal control methods to human movement problems.

The schedule for the workshop is as follows:
11:00-13:00 – Session 1
13:00-14:00 – Lunch break
14:00-16:00 – Session 2
16:00-16:30 – Coffee break
16:30-18:30 – Session 3

Below is a tentative outline for each of the two-hour sessions:

Session 1 - Motivation and Theory

I. Motivation for Exploring Direct Collocation Optimal Control
   a. Types of problems we typically try to solve
   b. Ways we typically try to solve them
   c. Problems we typically encounter
   d. Why direct collocation optimal control might be helpful
II. Theoretical Background for Optimal Control
   a. Calculus of variations in general
   b. Calculus of variations applied to optimal control
   c. Types of common optimal control problems

Session 2 - Numerical Solution Methods

I. Overview of Numerical Solution Methods
II. Specific Numerical Solution Methods
   a. Indirect methods – shooting and multiple shooting
   b. Direct methods – shooting and multiple shooting
   c. Direct collocation methods

Session 3 - GPOPS-II and Applications

I. Introduction to GPOPS-II Optimal Control Software
   a. Software overview
   b. Software structure
II. Human movement example problems (attendees pick 1 or 2)
   a. Combined inverse kinematics/forward dynamics
   b. Muscle force estimation
   c. Movement prediction

As part of the workshop, participants will learn how to use GPOPS-II optimal control software developed by workshop presenter Dr. Anil Rao from the University of Florida

(http://www.gpops2.com/). GPOPS-II can accommodate a wide variety optimal control problem formulations and works within the Matlab programming environment. To solve the human movement example problems using GPOPS-II, participants will need to bring a laptop (Mac or PC acceptable) with a legal copy of Matlab installed on it. Each participant will be sent his or her time-bombed GPOPS-II license file for use during the workshop along with download and installation instructions via e-mail prior to the conference.

Note: The goal of this workshop is not to market GPOPS-II optimal control software. That said, the software can be purchased for academic use for the minimal cost of $50 to cover administrative and support costs.