



OpenSim

Workshop on Modeling and Simulation of Human Movement

How the central nervous system selects appropriate muscle patterns to achieve a behavioral goal remains an open question. Numerical simulations are playing an increasingly important role in solving complex engineering problems, and have the potential to revolutionize medical decision making and treatment design. For decades, experiments have advanced the understanding of movement. Simulations can complement experiments to further advance this understanding by estimating important variables (e.g., muscle forces) and identifying cause-and-effect relationships (e.g., muscle contributions to movement) not generally measurable in experiments. A scientific framework of experiments and simulations will enhance basic studies and teaching of human movement control as well as bridge gaps between multiple disciplines (e.g., engineers and therapists studying rehabilitation and mathematicians and biologists studying neuroscience).

The present hands-on workshop will introduce you to OpenSim, a freely available software package that enables modeling and simulation of human and animal movement, including inverse dynamics analysis and forward dynamic simulation. OpenSim was introduced at the American Society of Biomechanics Conference in 2007. Since then, thousands of people have begun to use the software for research and teaching. The hands-on workshop at the 2011 Summer School on Neurorehabilitation will allow you to run simulations and analyze them to understand muscle function. You can download the software at <https://simtk.org/home/opensim> and get started with the tutorials before the workshop.

In particular, this workshop will provide a hands-on introduction to using OpenSim software tools for inverse dynamics analysis and forward dynamic simulation using an upper-extremity musculoskeletal model. In addition, this workshop will provide a special focus on interfacing OpenSim models with MATLAB/Simulink for closed-loop control of the simulated movement.

Agenda

Time frame	Objectives
14:00 – 14:15	Welcome and goals of the workshop
14:15 – 14:35	Inverse dynamics and static optimization
14:35 – 15:00	Guided analyses and exploration on your own
15:00 – 15:20	Forward dynamics simulation
15:20 – 15:45	Guided simulation and exploration on your own
15:45 – 16:05	Interfacing OpenSim models with MATLAB/Simulink
16:05 – 17:00	Guided control system design and exploration on your own

