BY KATHARINE MILLER

A Giant Leap for Open Source Simulation

Researchers can now create musculoskeletal models and simulations on an open source platform. In August, Simbios researchers released OpenSim 1.0. This freely available software can, in about 20 minutes, create 3D simulations of human movement at a level of detail and accuracy that just a few years ago would have taken weeks or months.

The software should benefit the entire field of computational biomechanics, says **Scott Delp, PhD**, professor of bioengineering and mechanical engineering at Stanford and co-PI of Simbios. "Until now, it has been difficult to reproduce the results of simulation papers. With OpenSim, we hope to promote continuity across the field."

Musculoskeletal simulations allow researchers to visualize complex movements; estimate forces that are difficult to model; perform "what if" scenarios; and look for cause and effect relationships. Ultimately, they can guide doctors to plan appropriate surgeries and physical therapy regimens.

Until now, biomechanics researchers doing dynamic simulations have either purchased commercial software or invented their own. "With models being developed in the same platform, it will be possible to exchange them between labs," says **Kurt Manal, PhD**, director of the Center for Biomedical Engineering Research at the University of Delaware, who attended OpenSim training in August. "That's not possible when each lab is using its own application."

OpenSim has an intuitive, windows-based graphical-user interface. Users can modify a large variety of physical parameters at a click of the mouse; overlay models on one another; and easily animate and make movies of their simulations.

At a recent OpenSim training course, Delp and his colleague **Clay Anderson, PhD**, led fifty eager attendees in a twenty-minute simulation of a person walking with and without a weakened soleus muscle. When the two animations were overlaid on one another, the difference in gait was obvious: there was a distinct knee drop for the individual with the weakened soleus.

Manal, who attended the training, says the tutorial worked perfectly. He and his students will use OpenSim right away. And when graduate students move on to postdoc or academic positions, they will be able to continue their work without interruption.
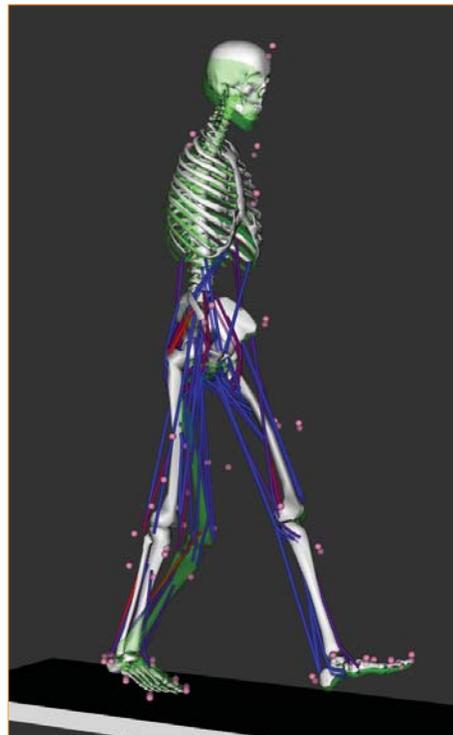
This snapshot shows two simulations overlaid on one another. The model in green has a weakened soleus muscle that leads to an exaggerated dipping of the knee. Courtesy of Clay Anderson, PhD.

Rick Neptune, PhD, an associate professor of mechanical engineering at the University of Texas, says OpenSim is computationally efficient and does many things really well. "It will be a valuable tool for a lot of research labs."

Over the next few years, OpenSim will continue to evolve and grow. "It's our goal to seed the community with this," says Delp. "But we need the community's help to improve it, develop plug-ins, models and simulations and distribute them to the biomechanics community." In a few years, if people have produced open source models for individuals with stroke and Parkinson's disease, models of the wrist, the foot, the upper extremities, walk/run transitions, cockroaches, T. rex, etc., "Then we've really got something," he says. □

DETAILS

Simbios released OpenSim 1.0 in August 2007. It can be downloaded at https://simtk.org/home/opensim.

Simbios is a National Center for Biomedical Computing located at Stanford University.