SimbiosNews

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A Big Step Forward for OpenSim

With its initial release two years ago, OpenSim offered researchers a powerful open-source application for simulating movement. Simple enough to be used by high school students yet advanced enough to address complex biomechanical research questions, OpenSim has attracted thousands of users since then. Now, OpenSim 2.0 promises greater opportunities for customization, enabling users to extend existing algorithms and integrate their own new algorithms within the OpenSim framework.

"Until now, OpenSim was only configured for certain research questions. If your question didn't fit, you'd have to either use other software or recast your question as something OpenSim could answer," says **Matthew DeMers**, a mechanical engineering graduate student at Stanford University and member of the Simbios OpenSim development team led by **Scott Delp**, **PhD**, professor in bioengineering at Stanford University. "Now, people can extend OpenSim and use it to answer a wide variety of questions."

The new version of OpenSim provides an application programming interface (API) to allow researchers access to core OpenSim functionality. Outwardly, this is the most noticeable change; however, it has also been re-engineered for better performance and flexibility.

"The whole structure underneath has been redesigned," says **Samuel Hamner**, another OpenSim development team member and Stanford University mechanical engineering graduate student.

While the graphical user interface will look the same, the development team rewrote the underlying code so that it is built entirely on Simbios' biosimulation toolkit, SimTK, with its robust, high-performing computational components, such as integrators, optimizers, and contact models.

Attendees at the first OpenSim Developers Jamboree held in October had the opportunity to work with a pre-release version of OpenSim 2.0 and were excited about what it would enable them to do.

Ilse Jonkers, **PhD**, a professor at Katholieke Universiteit Leuven in Belgium, has several research projects that utilize OpenSim, including the development of a neural controller to generate simulations of walking that account for neural reflex activity, and not just the mechanics. One of the main improvements Jonkers noticed during the workshop was the ease in defining controllers. "That, to me, is a huge advantage that we will exploit in the coming months," she says.

"The API is richer and cleaner," says **Tom Erez**, a graduate student in computer science at Washington University in St. Louis who studies machine learning and motor control. He appreciates being able to access functionality like the SimTK integrators with their built-in error checking.

However, he says, "the most revolutionary thing I saw was the elastic foundation model." Through SimTK, the new version of OpenSim will provide contact models—such as the elastic foundation—so that a simulation will recognize and model the behavior of two arbitrarily shaped bodies, such as bones, when they come together. For Erez, it means more flexibility in the simulations he runs. "I can generate force simulations from scratch. I don't need recorded ground reaction forces, and I don't need to hack my own ground-foot interaction," explains Erez. "It's a big step forward."

The value of OpenSim and its continued enhancements is also clear to Jonkers. "Without OpenSim, I couldn't do my research," she says. □

DETAILS

OpenSim 2.0 was released in December 2009. To download the software and learn more about training opportunities, visit http://simtk.org/home/opensim.

Simbios (http://simbios.stanford.edu) is the National Center for Biomedical Computing located at Stanford University.