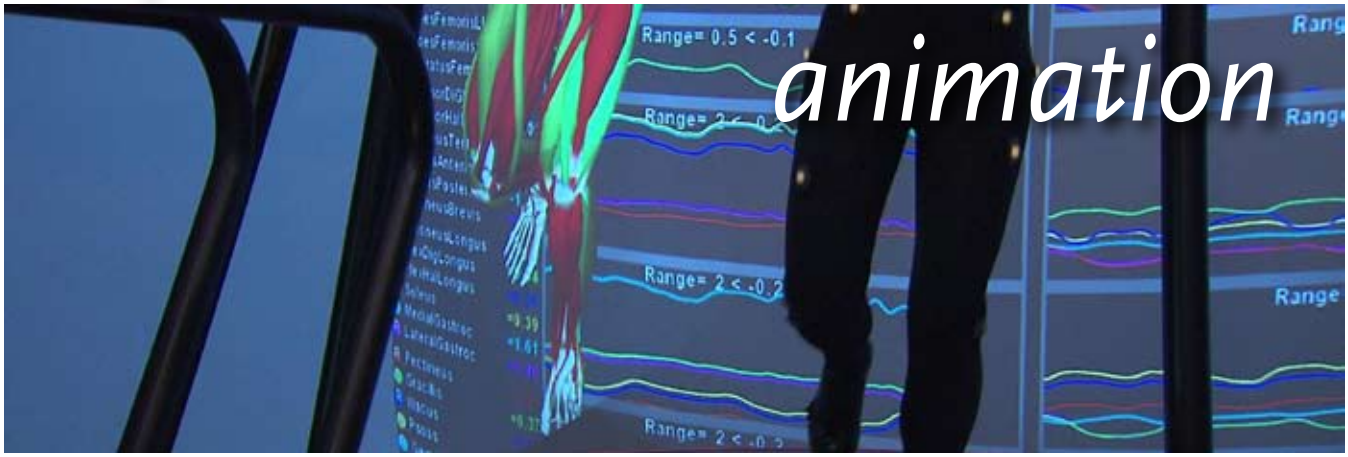
Physics-based character animation



MOTION CONTROLLER

Developing motion controllers to animate virtual characters using simulated physics.

Knowledge Transfer Project:
Real-time Physics Based Motion Controllers for Animated Characters

Partners
Utrecht University
Motek Medical

Budget
100.000 euro

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Standard character animation techniques directly manipulate the pose of a virtual character. This allows for maximum control, but the resulting motions are often not physically realistic. An alternative technique is to create animations using physical simulation.

The goal of this project is to develop a system that will be able to generate animations by controlling muscle activity or joint torques of a character model in a physical simulation. The resulting motions are expected to be both realistic and biomechanically correct.

Human Body Model

This project is a collaboration between Utrecht University and Motek Medical, a company specialized in using virtual reality and real-time hardware integration for the purpose of rehabilitation. They have recently developed the Human Body Model, a system that can visualize a person's muscle activity in real-time, based on motion capture data.

"The Human Body Model can visualize a person's muscle activity in real-time, based on motion capture data"

The result of this project will be a number of demonstrators and prototypes focused toward integrating motion capture animations and muscle simulation systems for motion analysis and synthesis, based on research performed at Utrecht University.
One of those demonstrators will be an animation evaluation tool that uses the Human Body Model to evaluate the quality of animations that are based on motion capture data. This tool is expected to create a synergy between musculoskeletal modeling and computer animation. Another result will be a tool that is able to generate new motions. This tool will use a musculoskeletal or mechanical model in a forward dynamics simulation, resulting in motions that are physically realistic. Such motions can be optimized for specific criteria, such as walking speed or balance stability.

Applications in rehabilitation

The system is expected to have many applications related to rehabilitation. It can for instance be used as a learning tool that shows a patient how to move optimally with a specific injury or disability. The system can also be used to predict a possible outcome of a specific modification to the musculoskeletal system. This may be helpful in determining the effect of a specific surgical procedure.
This project runs for a total of 2 years and 3 months. The first year of the project mainly consists of research on musculoskeletal modeling and techniques for designing motion controllers. The second year focuses on software development and integration of the software into Motek's applications. The final three months of the project consist of finalizing the development to produce demonstrators, as well as writing publications for scientific conferences and journals.