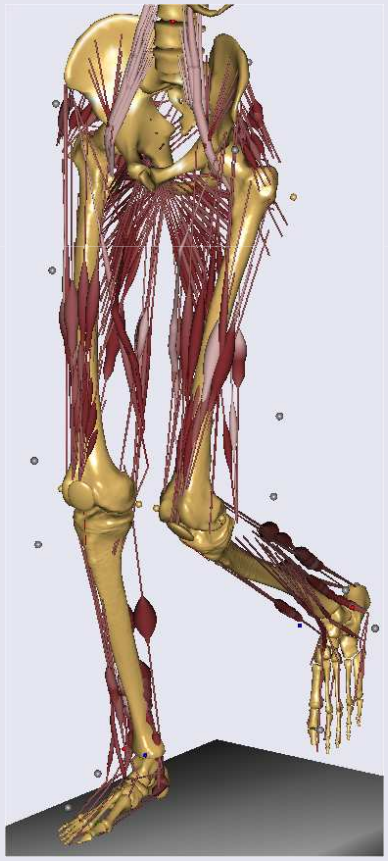
Streamlining gait analysis with the AnyBody Modeling System v.5

Søren Tørholm Ph.D.
AnyBody Technology, Aalborg, Denmark



The web cast will start in a few minutes….

Why not spend the time checking these points:

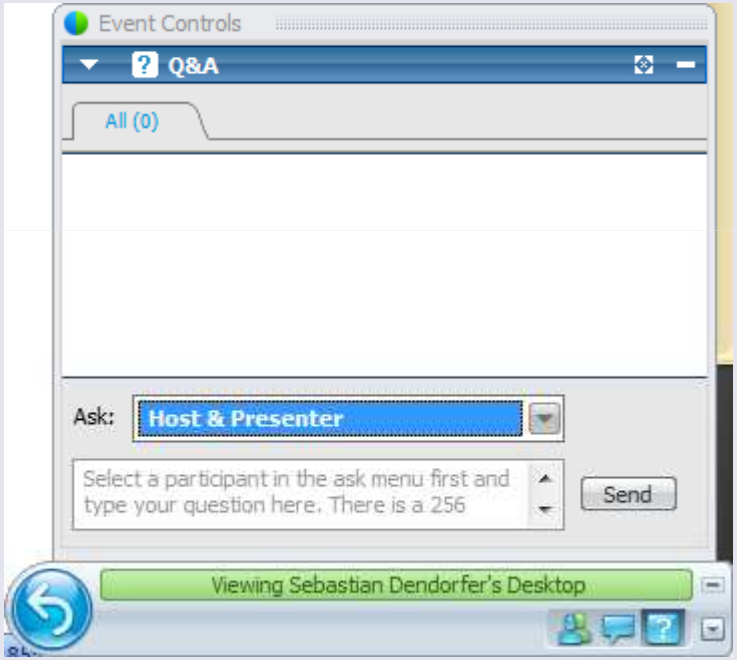
Does your screen fit the presentation?
The “Sharing” menu (upper right corner)->View->Autofit

Is your system set up to receive the broadcasted sound?
www.anybodytech.com >Events > Webcasts (bottom of the page)

Questions, it is ok to ask

- Launch the Q&A panel

- Type your questions in the Q&A panel.
- Send the question to ”Host, Presenter & Panelists”



Notice the answer displays next to the question in the Q&A box. You may have to scroll up to see it.

Presenters

Søren Tørholm
(Presenter)

Arne Kiis
(Host/ Panelist)

ANYBODY TECHNOLOGY

Agenda

- The AnyBody Modeling System
- Leg model
- Validation
- Demonstration
- Question and answering session

ANYBODY TECHNOLOGY

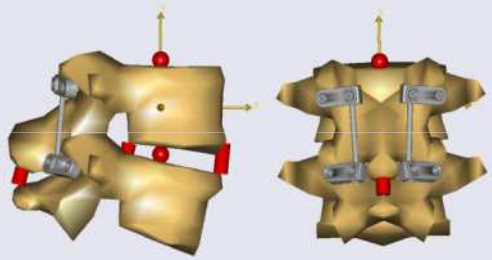
AnyBody Modeling System

- Developed for musculoskeletal analysis
- Self-contained system
- Fully developed and supported in-house (since 2001)
- Open body model (since 1997)
- Multi-level model validation
- Interfacing to
  - Motion capture
  - Medical image based bone and muscle data
  - Finite element software

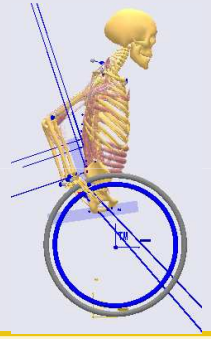
ANYBODY TECHNOLOGY

Product design optimization

Ergonomic analysis and documentation



ANYBODY Modeling System

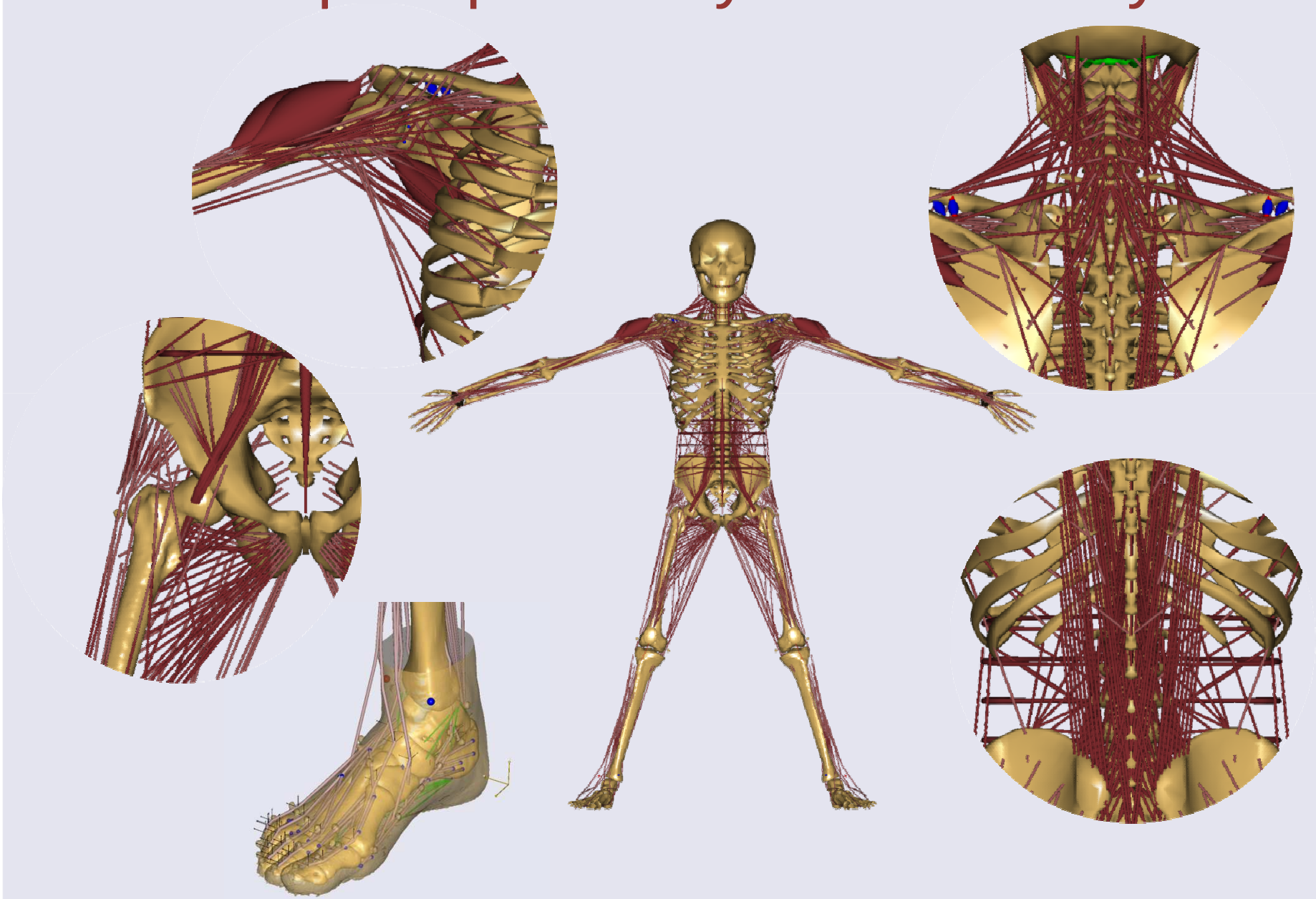


In-vivo load cases for Finite Element Analysis

Pre-op planning and post-op evaluation

ANYBODY TECHNOLOGY

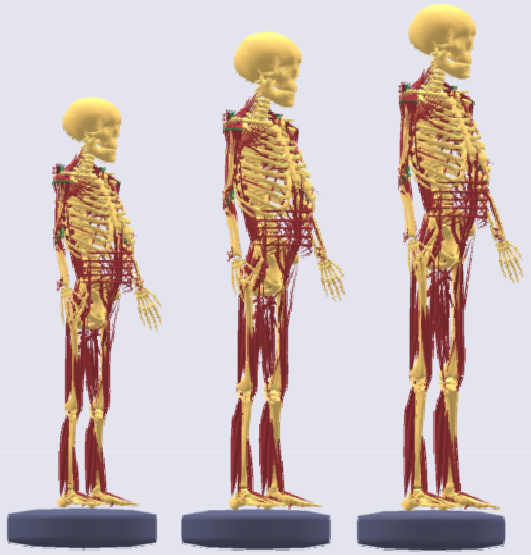
Unique open body model library

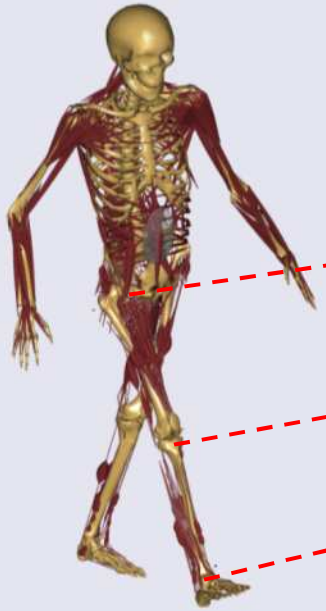


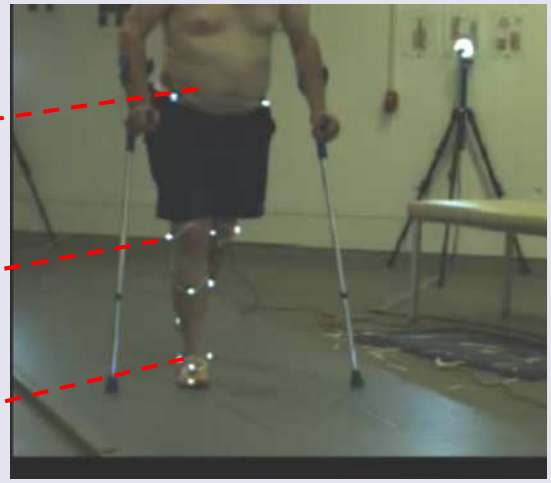
Body model customization

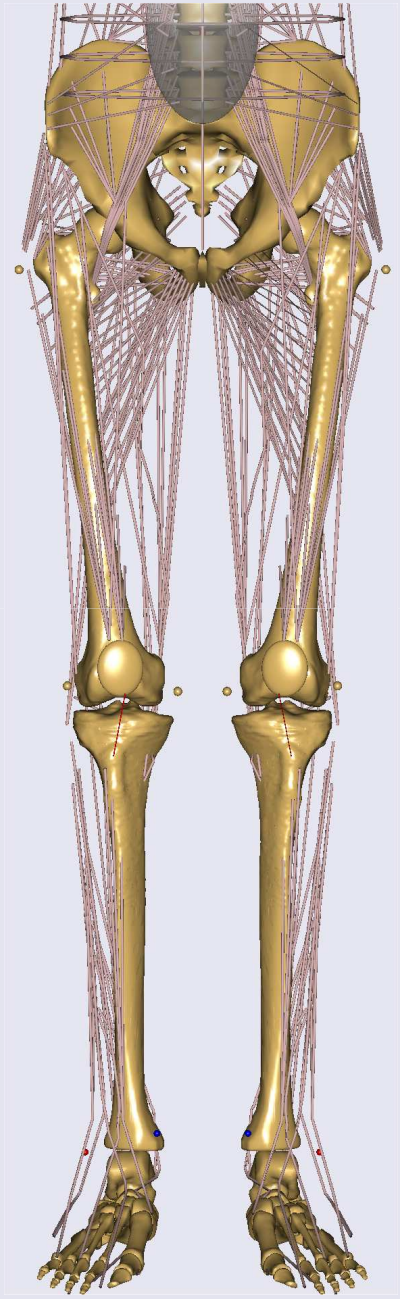
Increasingly patient specific

- Anthropometric scaling
- Automated scaling
- Strength calibration
- Bone shape matching
- Effects of surgical procedure
- Muscle physiology
- …



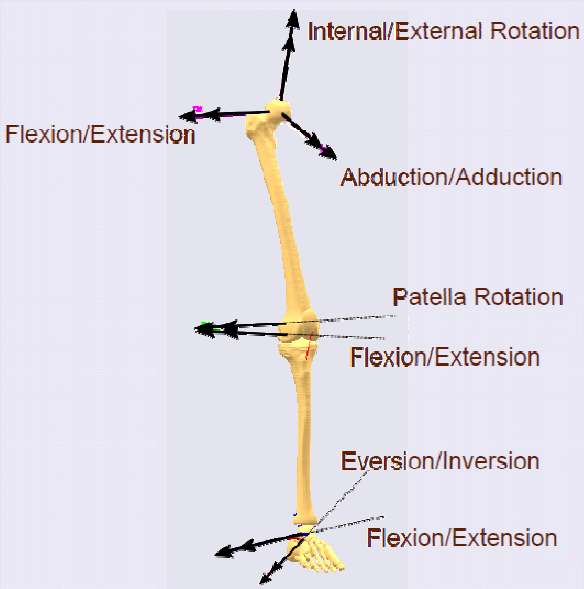


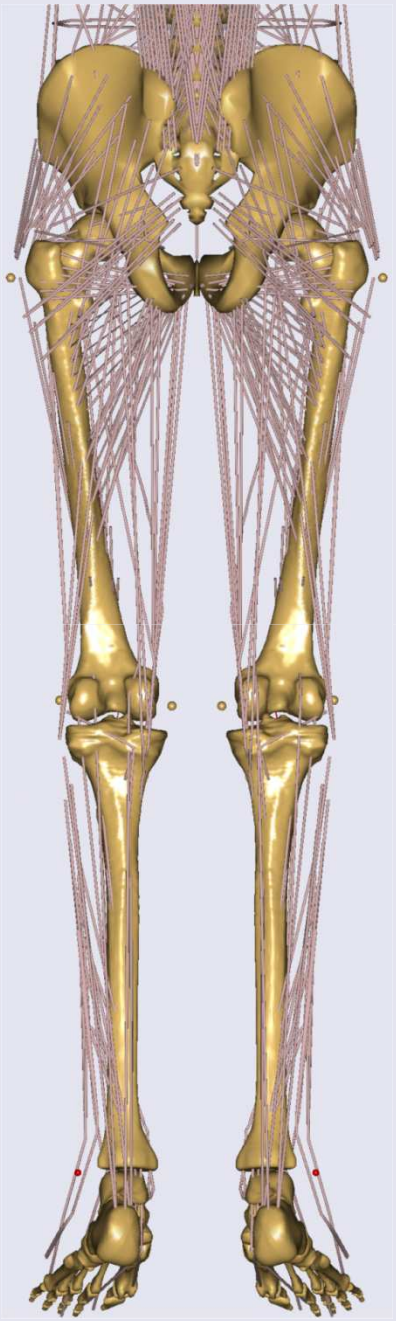




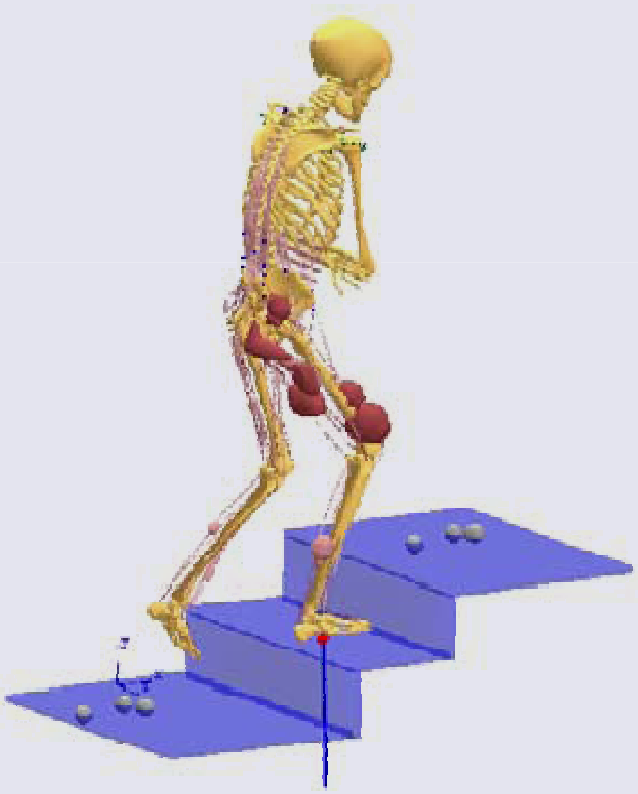
Leg

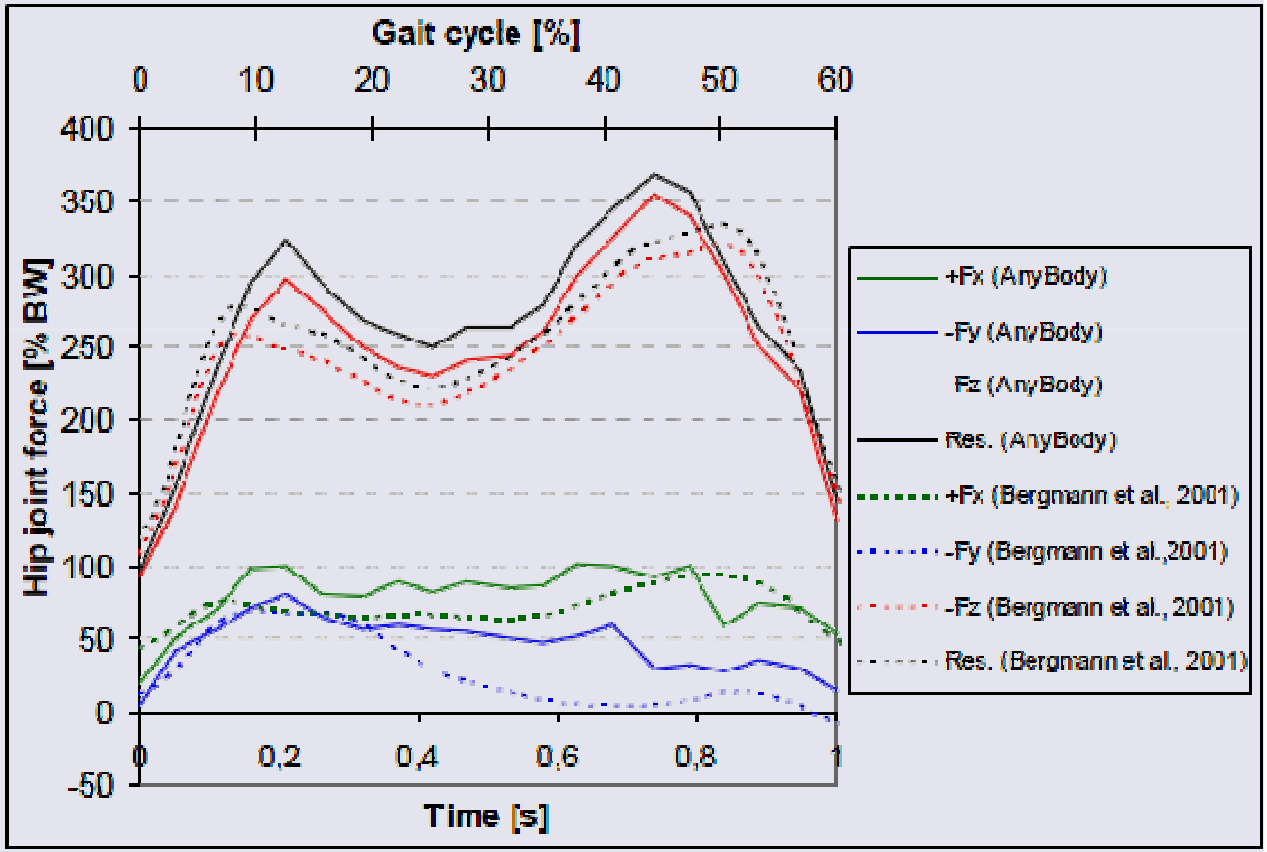
- Comprehensive and consistent dataset from one donor (77 y, 1.74 m, 105 kg)
  Klein-Horsman, 2007
- 55 Muscles divided in 159 fascicles per leg
- 7 degrees of freedom





Simulation vs. in-vivo measured joint forces

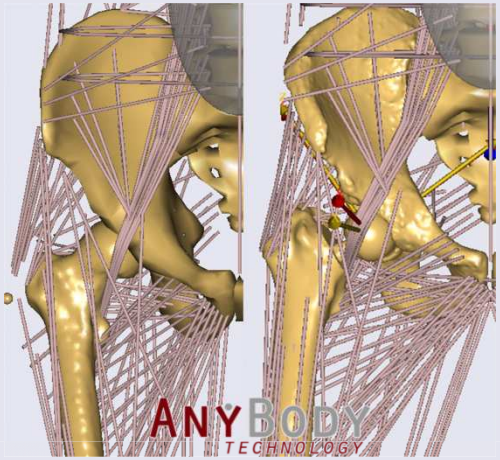




Thielen et al. 2009: ANSYS Conference & 27th.CADFEM Users' Meeting, Leipzig, Germany

New and recently added features

- Subject specific modeling
- Contact modeling
- Force dependent kinematics
- Finite element interfacing
- Enhanced user interfacing tools
- Definition of projects

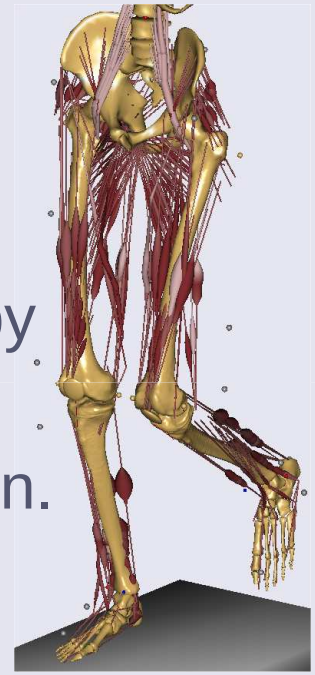


Related webcasts:

- Patient-specific morphing of musculoskeletal models. Prof. John Rasmussen, March, 1st

Gait model basics

- Detailed model output available
  - Muscle forces/activation
  - Joint reaction forces
  - Muscle length variations
- Problems of over-determinacy were recently solved by Andersen et al.
- Additional benefit of automatic parameter identification.
- Models becoming an actual gait application.
- Aim: Seamless integration with motion capture technology.



A computationally efficient optimisation-based method for parameter identification of kinematically determinate and over-determinate biomechanical systems
Andersen, M. S., Damsgaard, M., Mac-Williams, B. & Rasmussen, J. 2010 I : Computer Methods in Biomechanics and Biomedical Engineering. 13, 2, s. 171-183.

Gait demo

1. Basic structure of new C3DProject* model
2. How to read in a new C3D file
3. Hook up force plates
4. Define markers and adjust their position
5. Adjust model position to match recorded markers
6. Run motion and parameter optimization
7. Show results from dynamic simulation

*C3DProject model used as starting point for this demo is part of AMS ver. 5.0.1

The data

Marker protocol is a modified version of the PlugInGait protocol with extra markers on thigh, shank and foot.

Forces measured using two force plates

C3D file used in demo is kindly provide by Sjoerd Kolk, The Radboud University Nijmegen Medical Centre

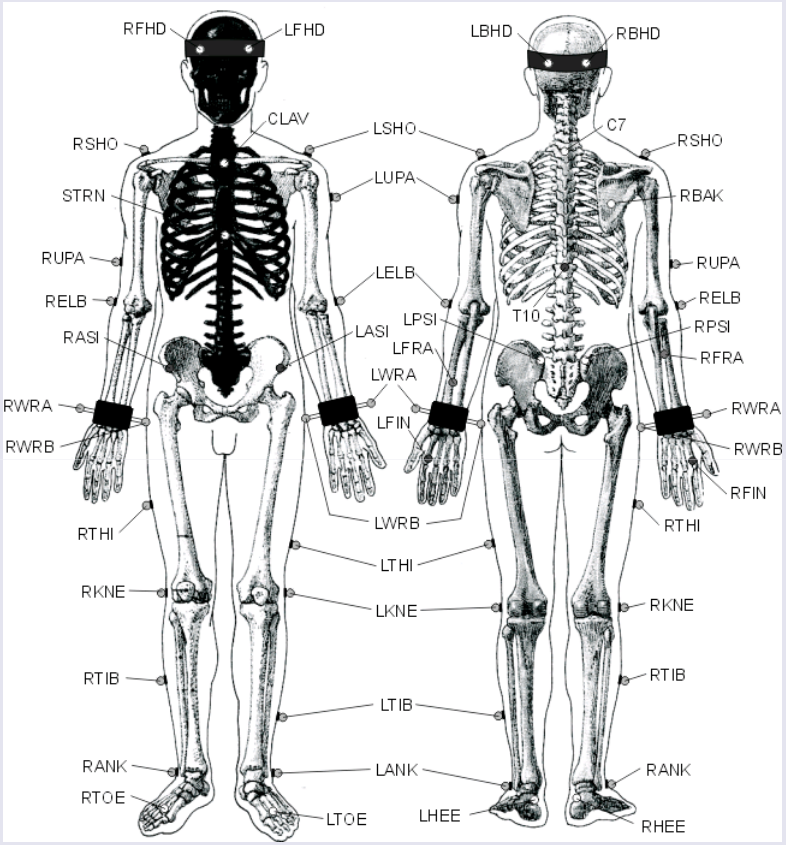


Illustration from http://fourms.wiki.ifi.uio.no/images/4/4b/Plug-in-Gait%2BMarker%2BPlacement.pdf

Conclusions

- Models can be driven easily using all markers.
- Redundancy is exploited for automatic scaling. Might enhance accuracy.
- Multiple experiments with the same marker set can be processed very quickly.
- The method is independent of marker sets: new sets can easily be defined and adjusted in GUI
- More force platform types will become available.
- Project definition guides the workflow

Thank you !
Q & A