Features of the new AnyBody Modeling System, version 5.2

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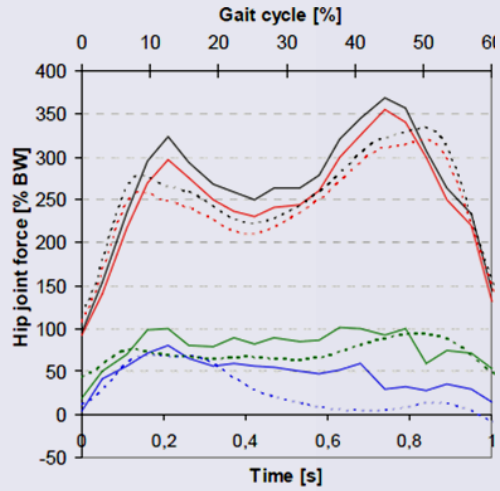
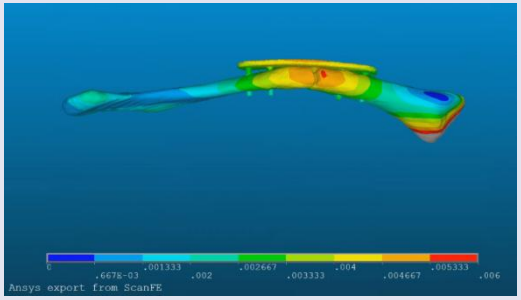
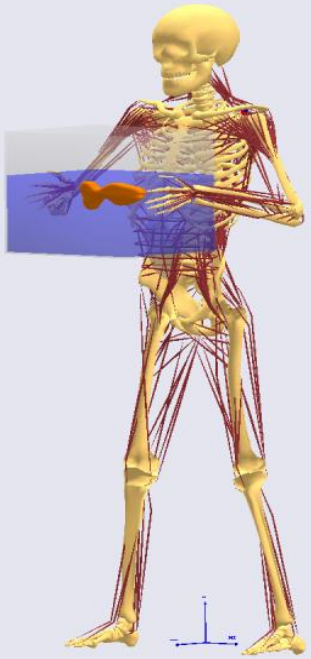
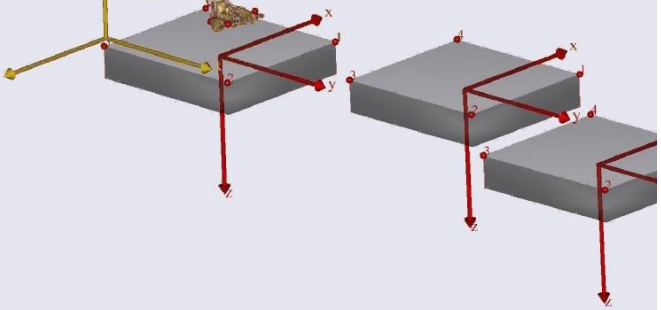
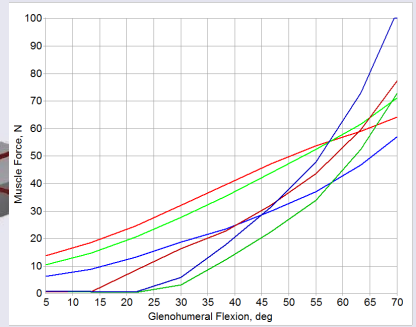
The web cast will start in a few minutes….

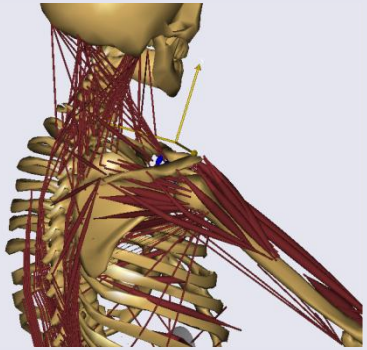








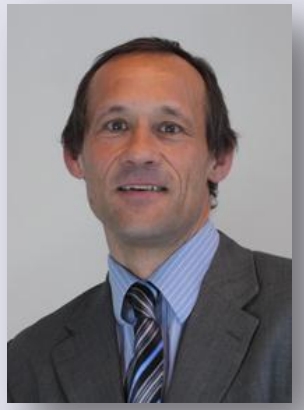




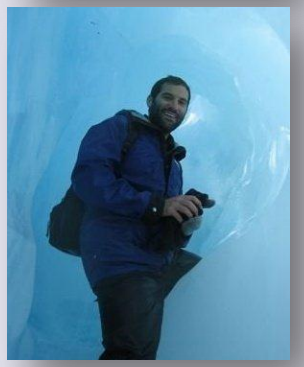
Agenda & Presenters

- Who is AnyBody?
- AnyBody Modeling System
- AnyBody Model Repository
- AnyBody Applications
  - Ergonomics/Product Design
  - Physiological Loads for FEA
  - Surgical Planning
- Q & A

Arne Kiis
(Host/Panelist)



Amir Al-Munajjed
(Presenter)



Søren Tørholm
(Panelist)

AnyBody Technology

- Software licenses
- Consulting
- Training
- Support
- US Office
- AnyGait

2002

2006

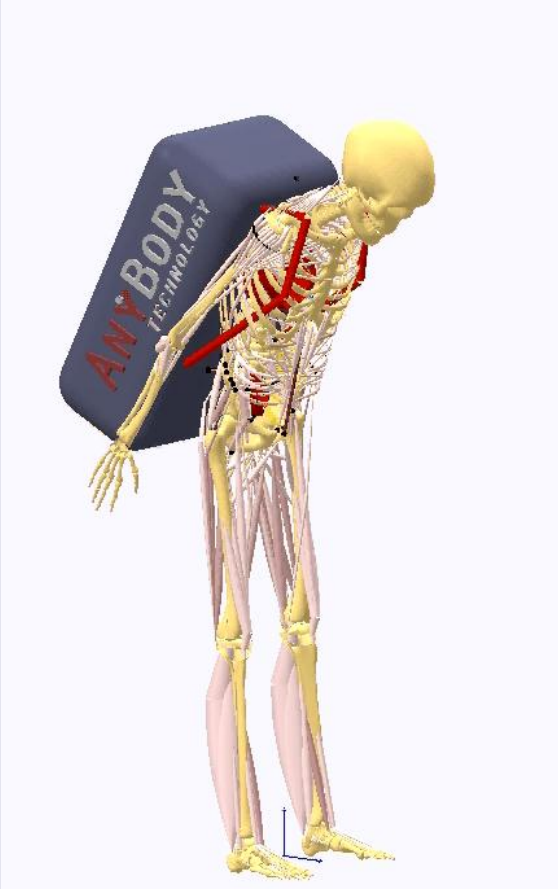
2010

2011

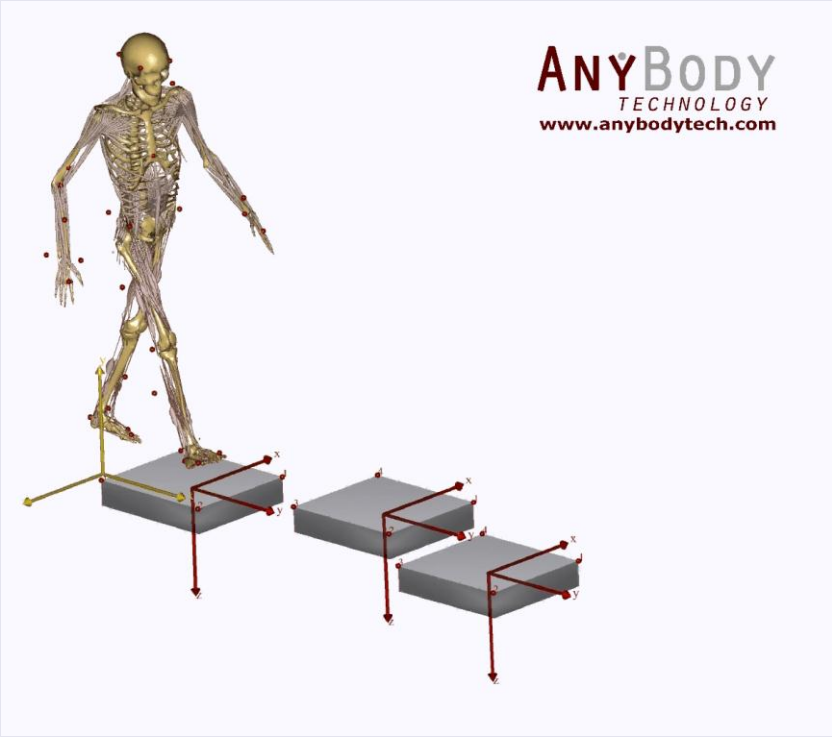
2012

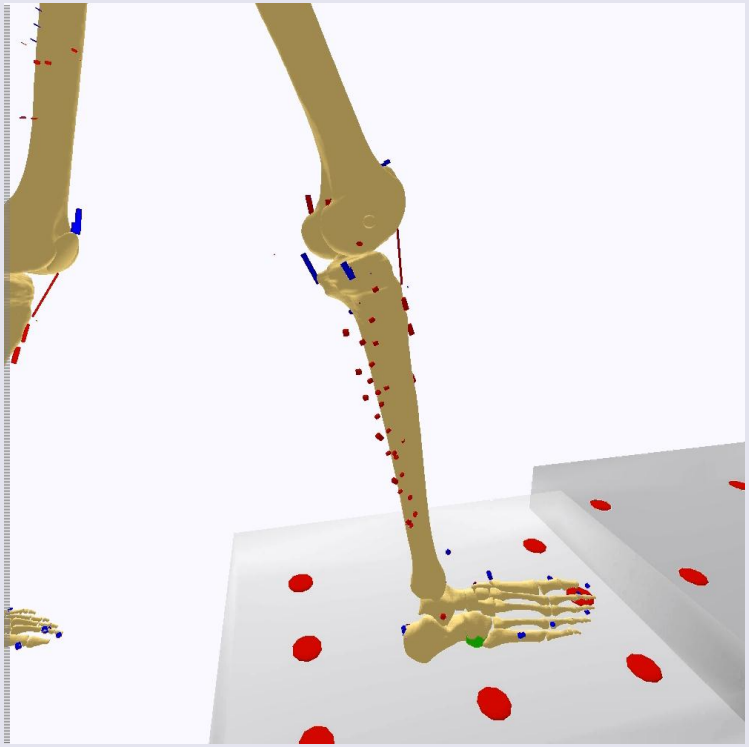
AnyBody Modeling System

- Developed in-house for musculoskeletal analysis
- Self-contained system
- Interfacing to
  - motion capture
  - image-based bone and muscle data
  - finite-element software
  - office systems
- Open body model
- Broad and deep model validation
- API for imbedded use



AnyBody Modeling System





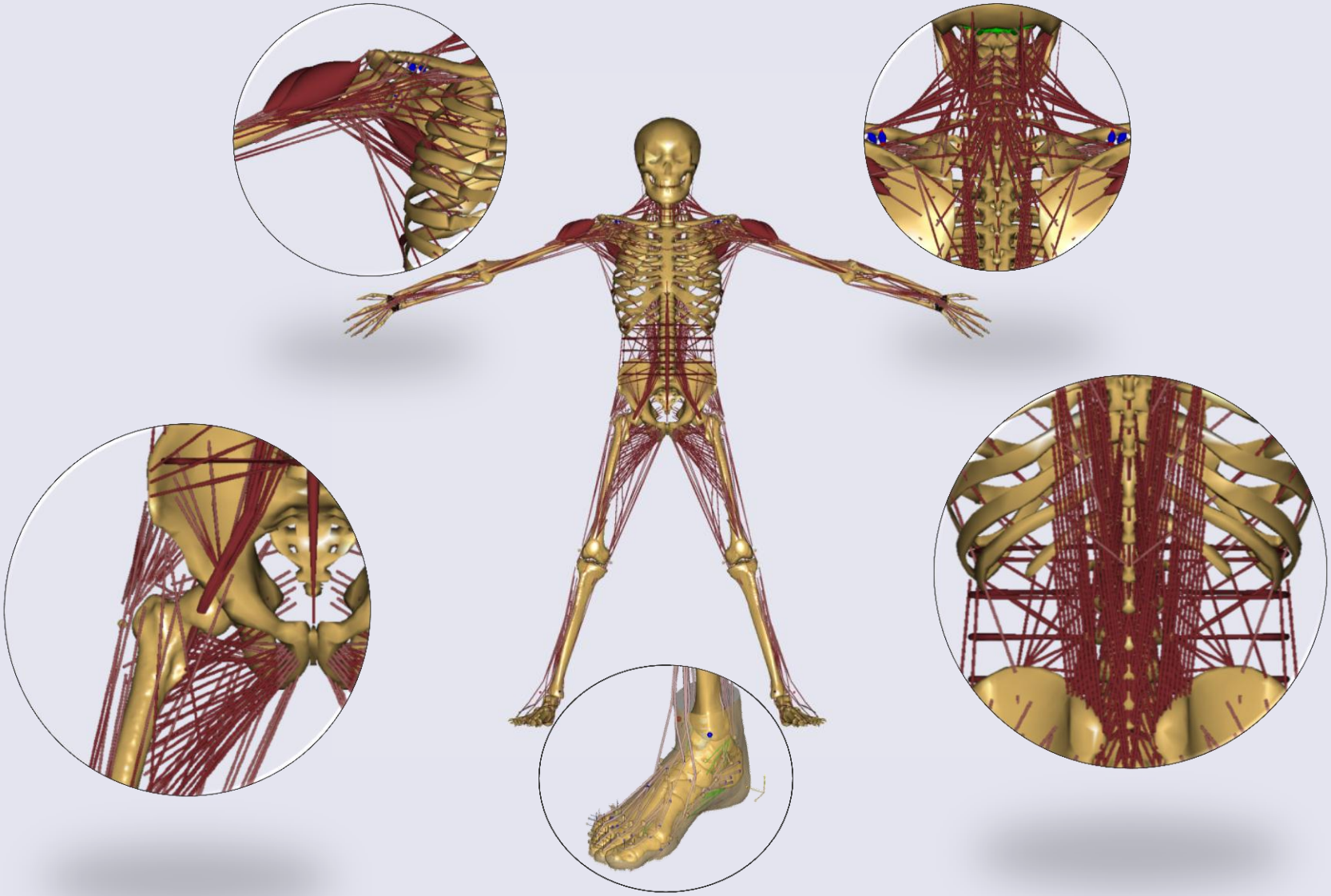
Motion & ext Forces as Input:

- Motion Capture (Vicon, Qualisys, ...)
- Joint Angle Input

Forces as Output:

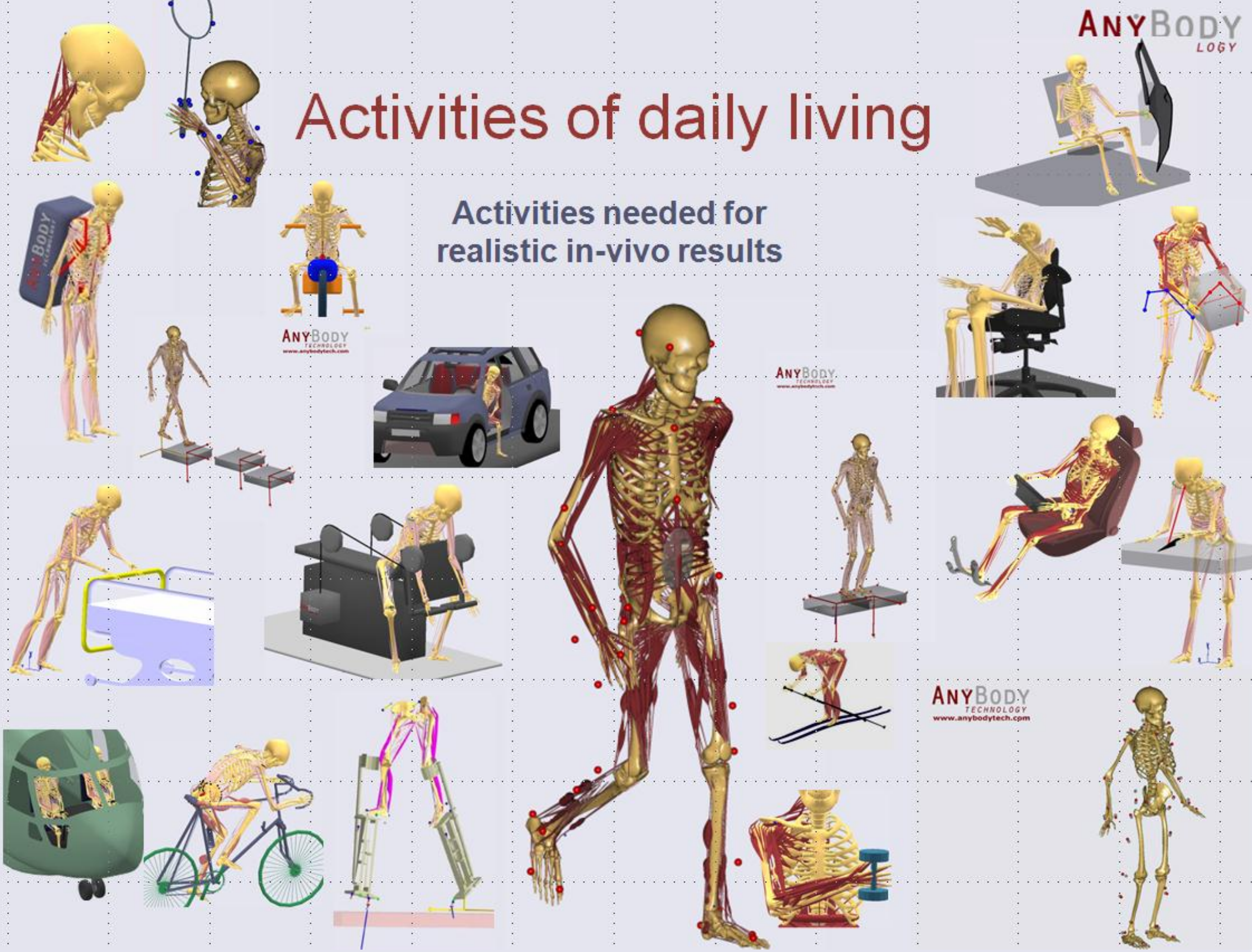
- Muscle Forces (activations)
- Joint Reaction Forces

Model Repository

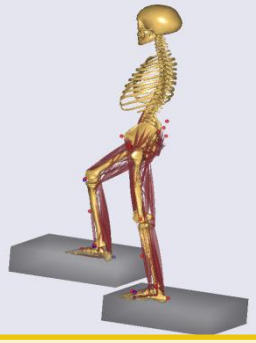


Activities of daily living

Activities needed for realistic in-vivo results

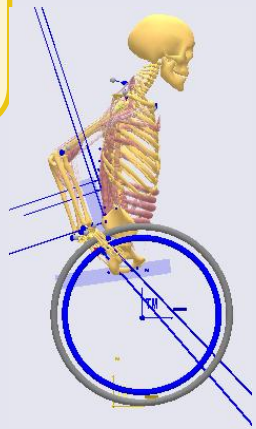


ANYBODY TECHNOLOGY



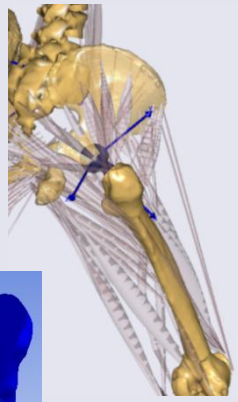
Gait Application
AnyGait

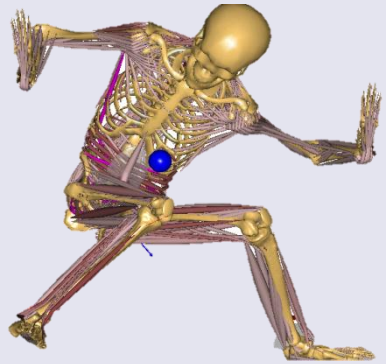
Product Design
Optimization

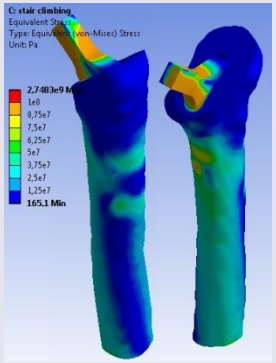


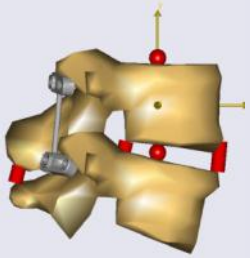
Ergonomic
Analysis and
Documentation

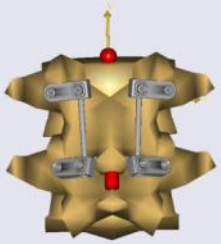
ANYBODY
Modeling System







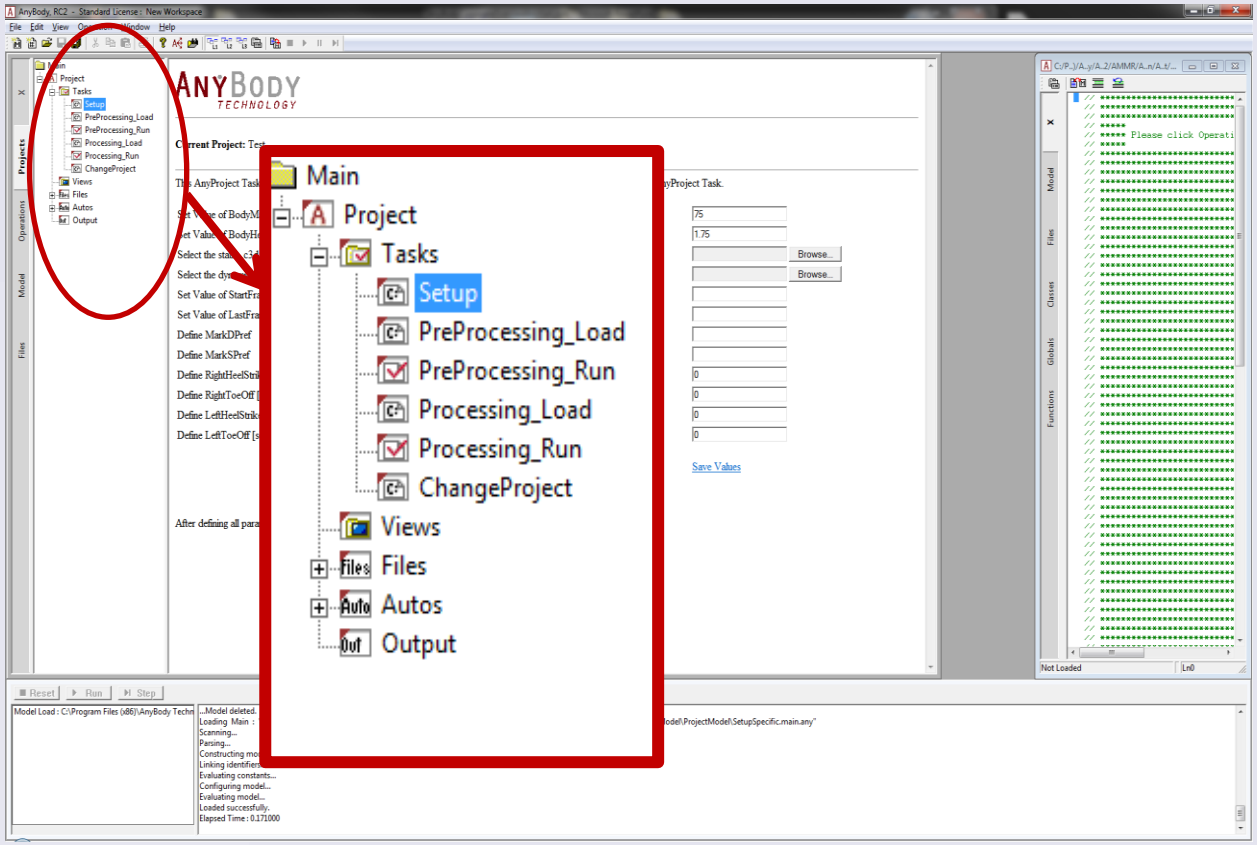


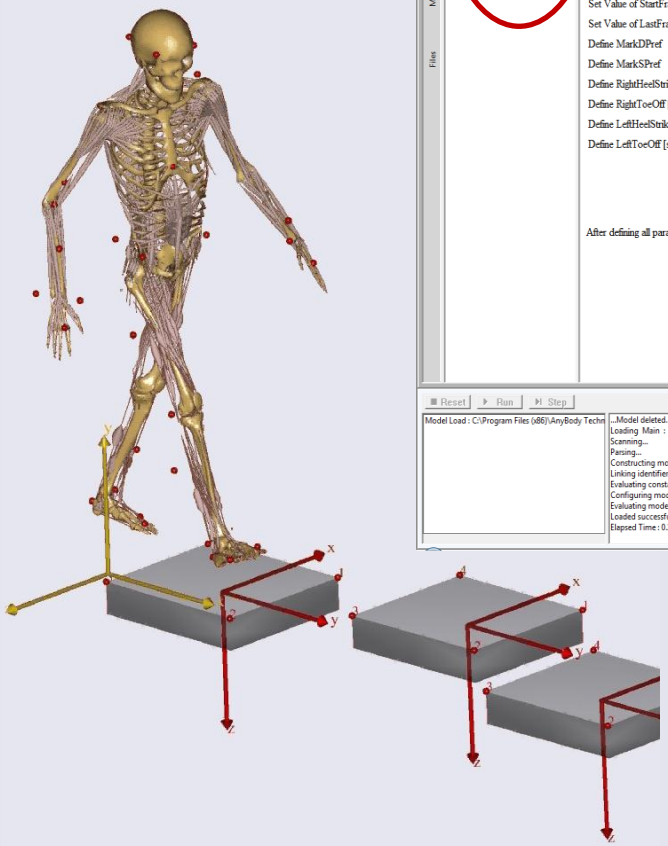


Physiological Load
Cases for Finite
Element Analysis

Surgical Planning, -
Evaluation & -Failure
Analysis

AnyGait



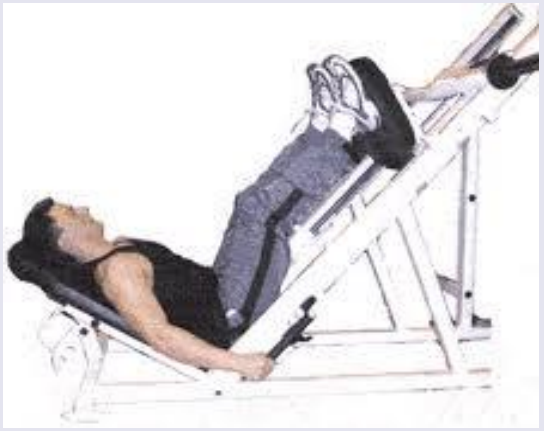


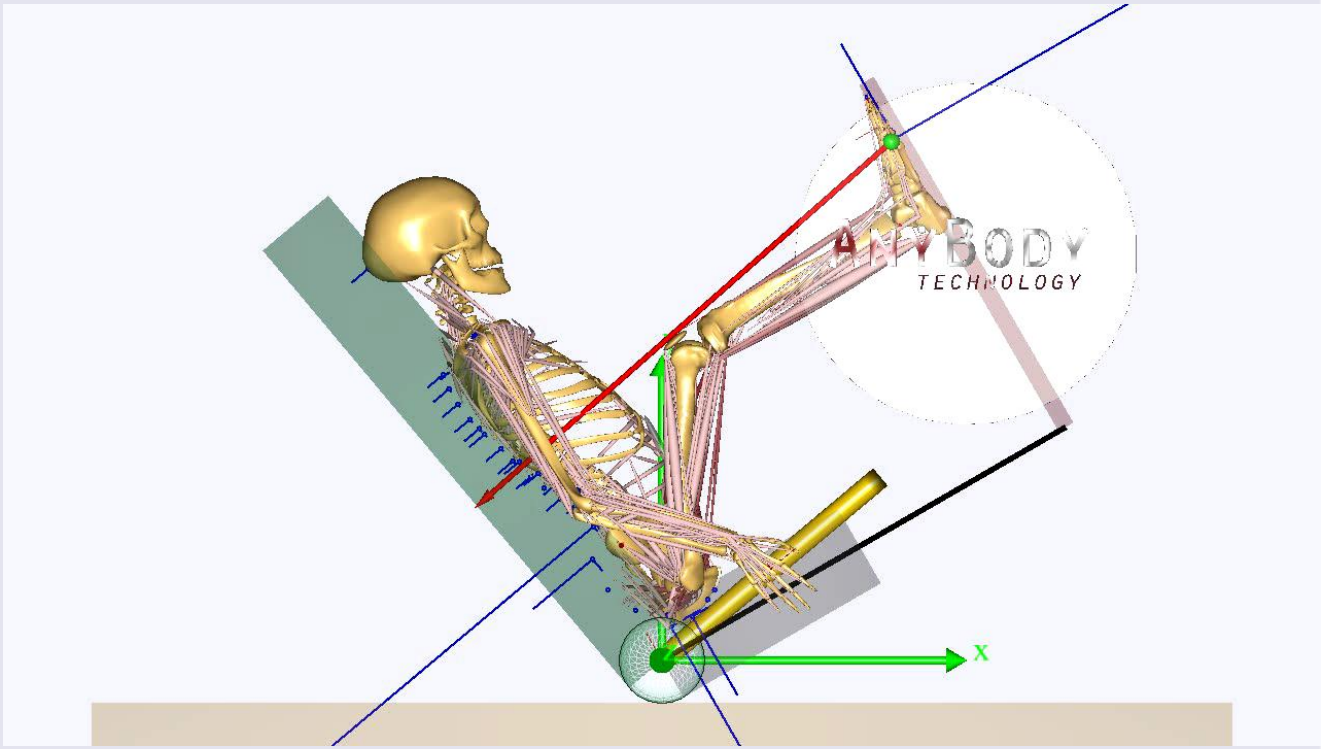
see previous Webcasts on AnyGait from:
- Amir Al-Munajjed

at *www.anybodytech.com*

Product Design Optimization

LegPressMachine for Ergonomics and Product Design Optimization

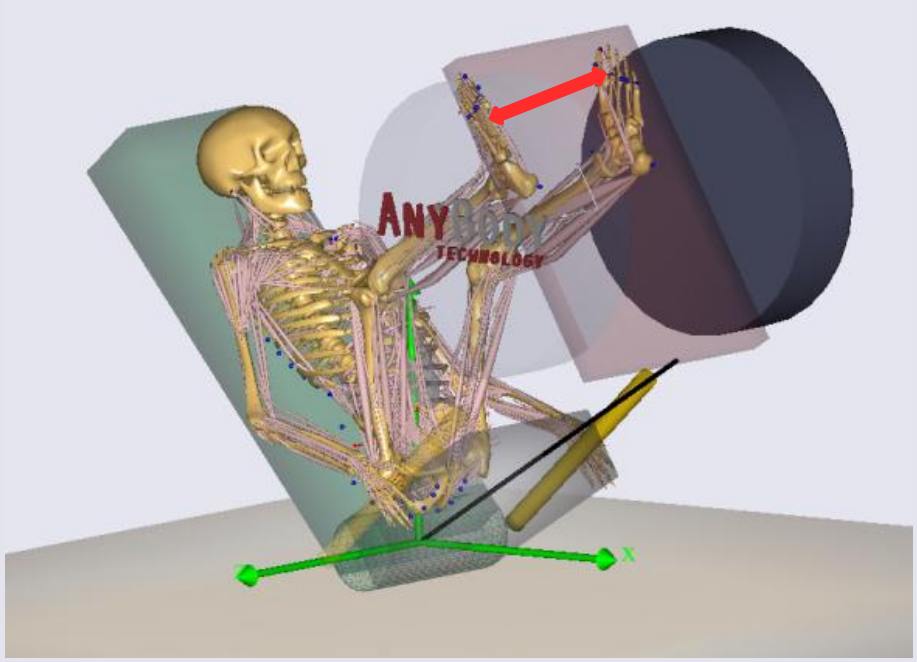


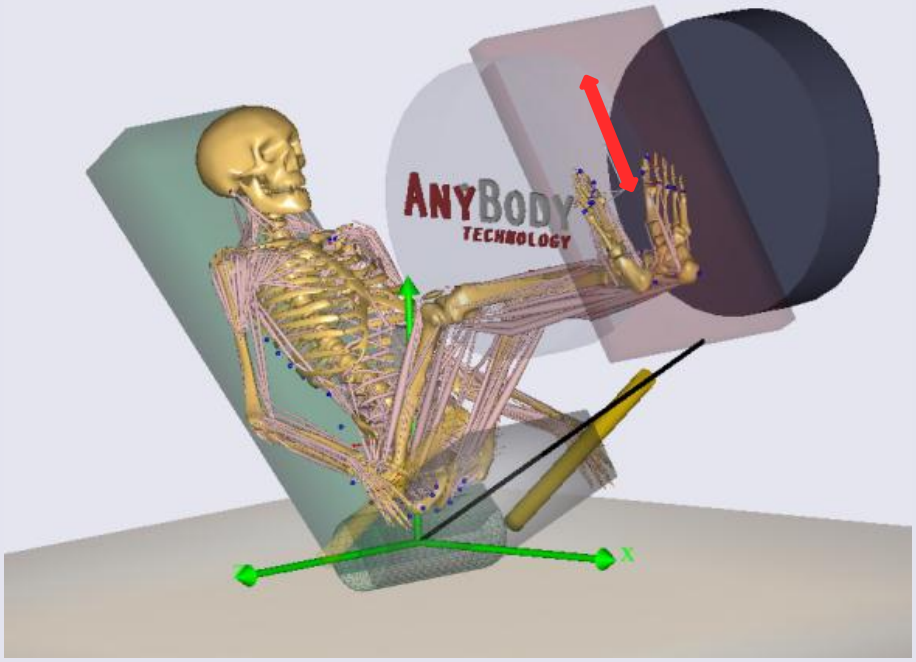


What is the optimal position for the foot?

What is your target function?

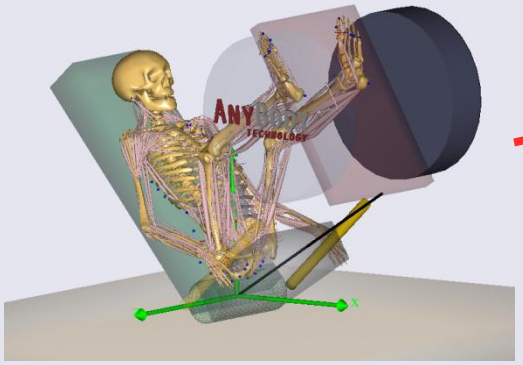
LegPressMachine



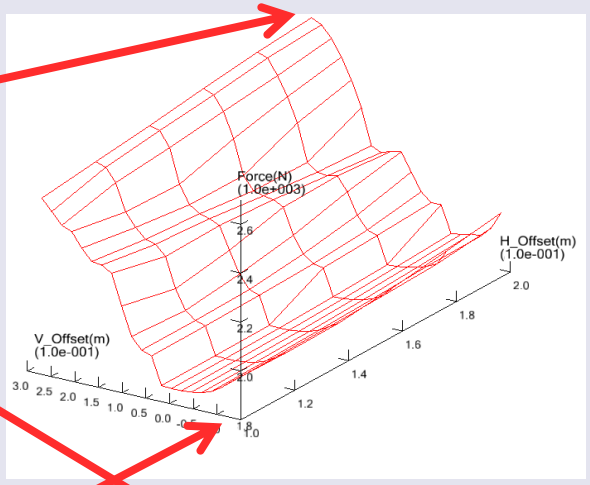


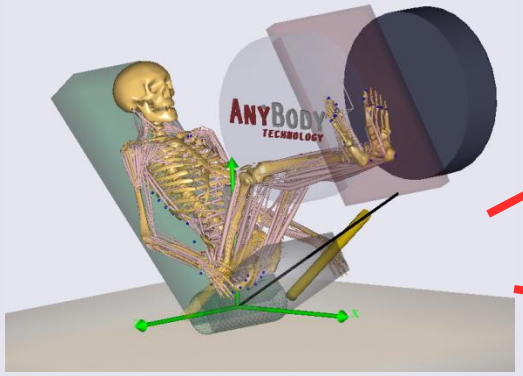
Knee Reaction Force & Leg Muscle Activation Envelope

LegPressMachine

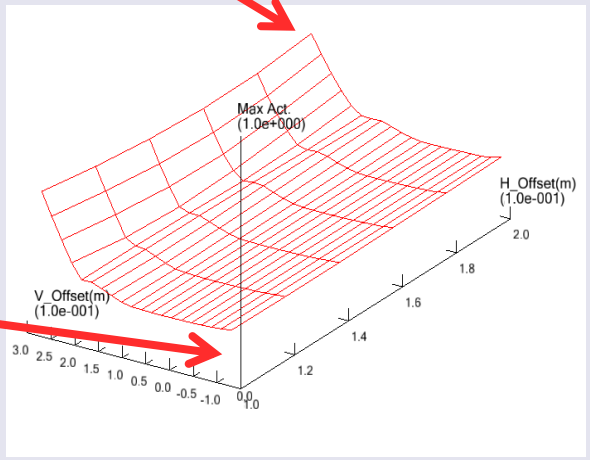


High knee force & leg muscle activation



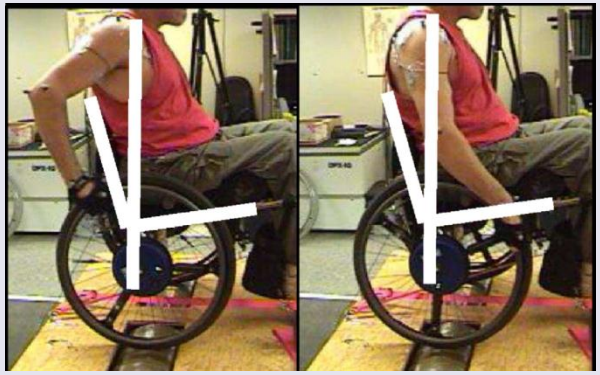


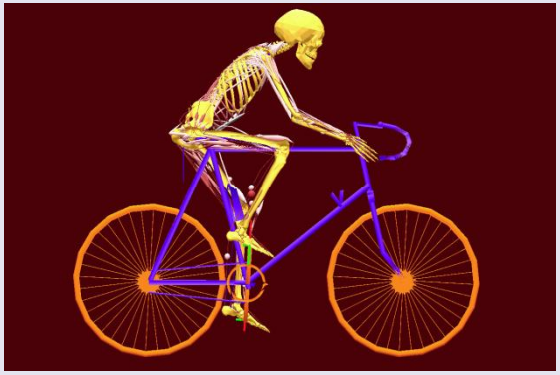
Low knee force & leg muscle activation

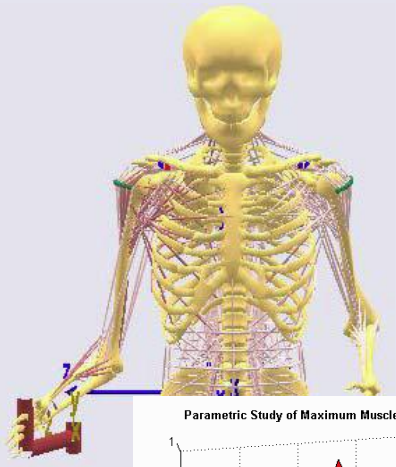


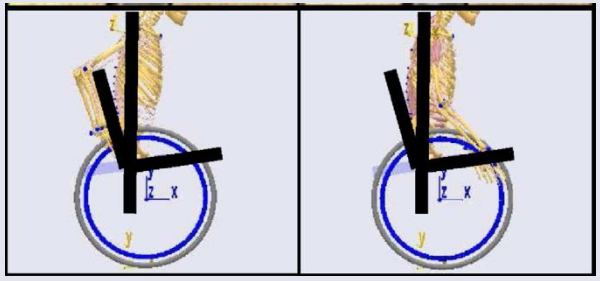
New 5.2: Advanced Optimization Solver

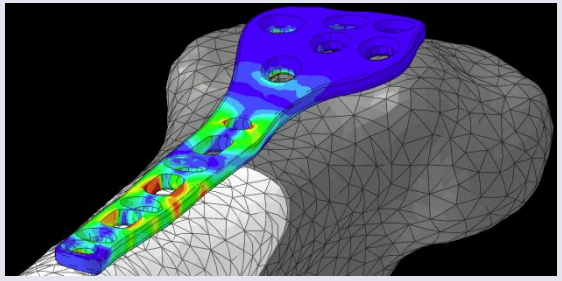
Optimization Examples

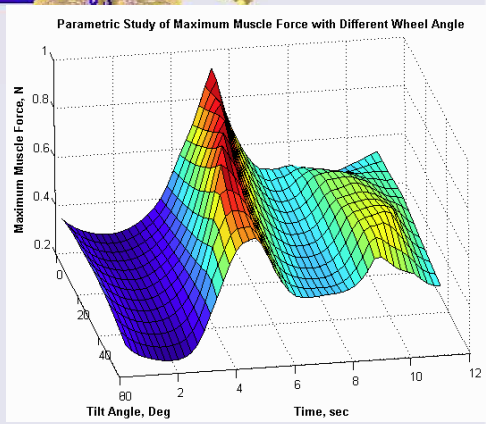










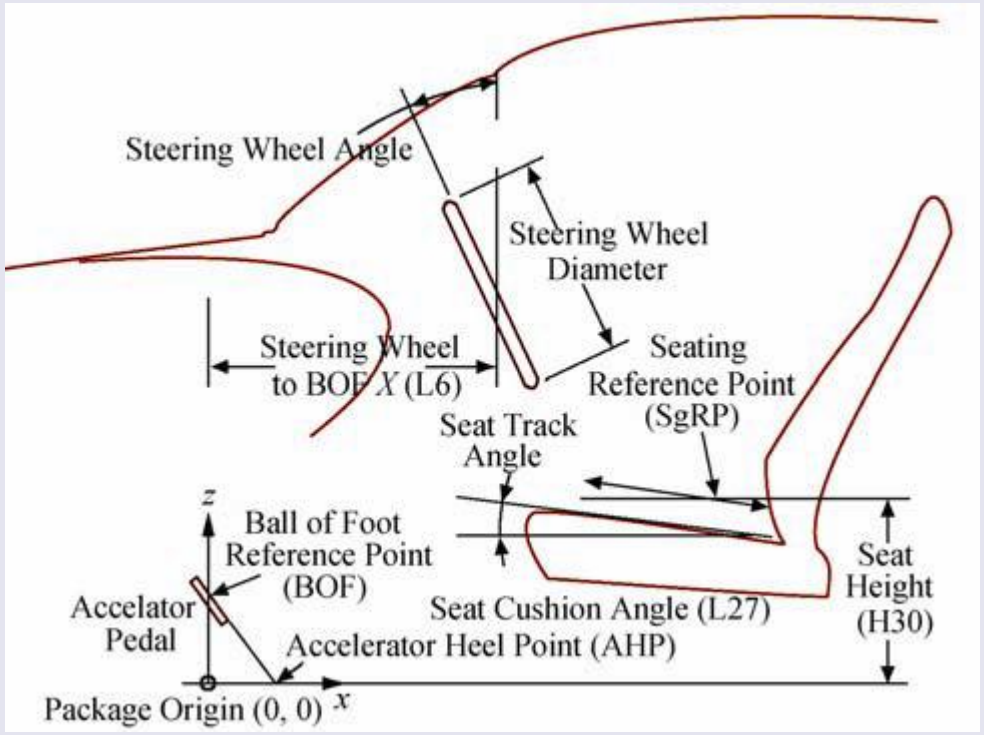


Dubowsky et al., 2008

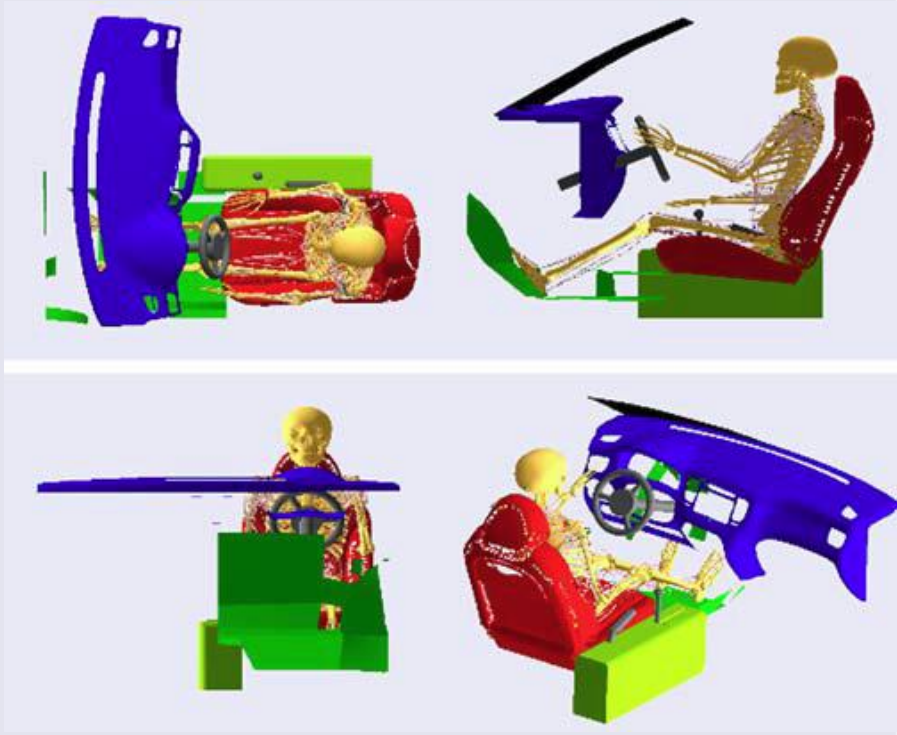
Grujicic et al., 2010

Lee et al., 2009

Package Design & Optimization



Jung et al., 2009



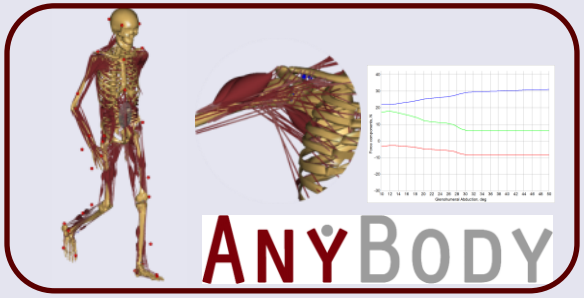
New 5.2: Moving Ref Frame

AnyBody – Finite Element Workflow

Daily Activities

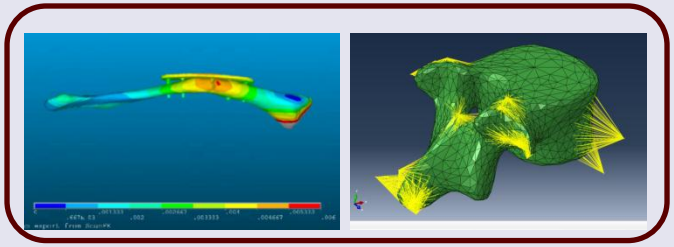
Motion

AnyBody
Modeling System



Load Case

Finite Element
Analysis



ANSYS

SIMULIA

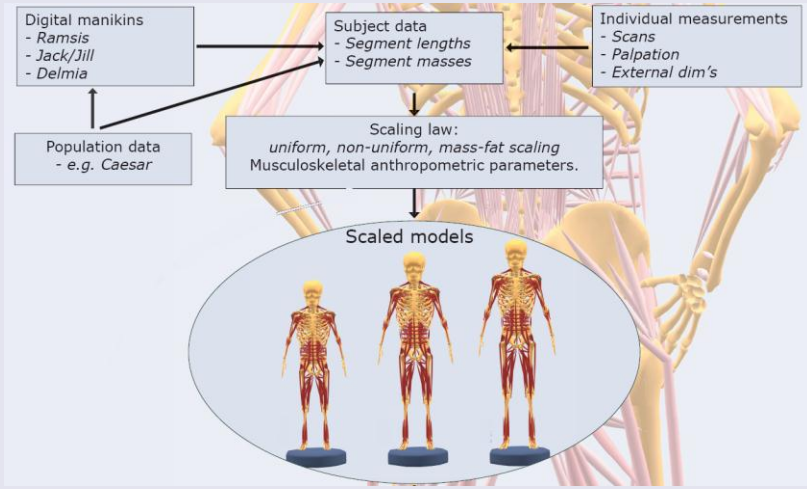
Subject - Specific Modeling

Standard avg.
European Male

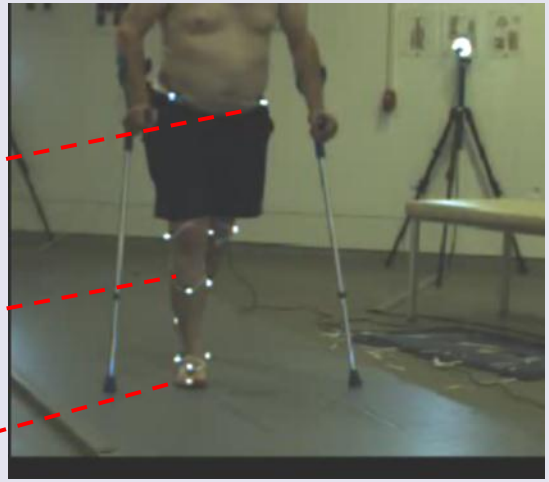
Anthropometric Scaling

Kinematic Scaling: Dynamic or Static

Morphing:
Subject Specific
Bone Geometry

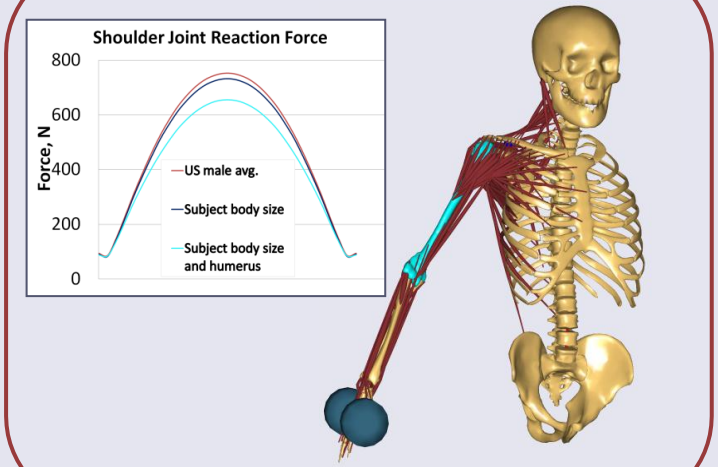


See previous Webcast on Anthro Scaling
Rasmussen et al. 2005



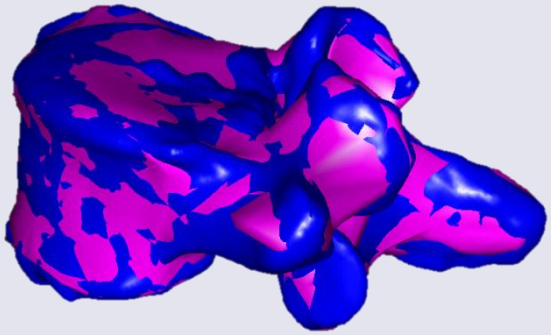
Andersen et al, 2010a/b & 2012

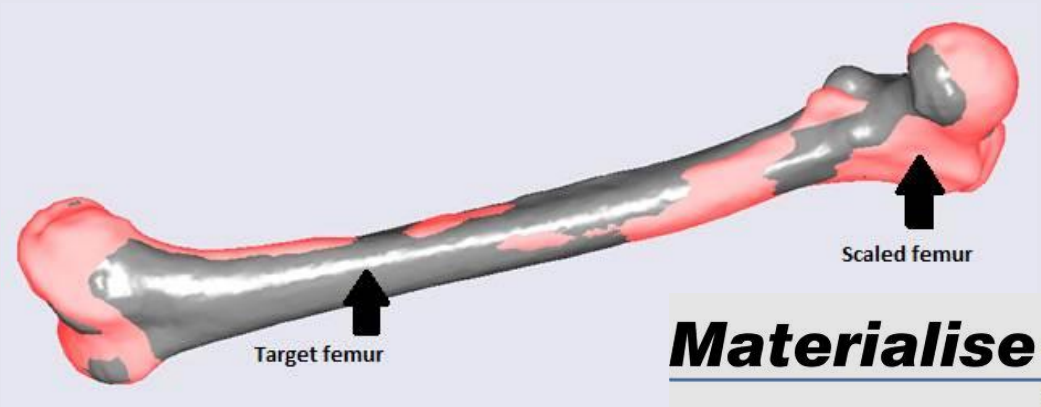
Patient Specific Scaling



Increase Accuracy of Your Model:

- Subject-Specific Details (Inter-Subject Variability)
- Individualized Results for Patient-Specific Planning.
- Precise Geometry for e.g.:
  - Facet Joint Contact in Spine
  - Impingement in Hip





Patient Specific Scaling

Medical Image to 3D Geometry:

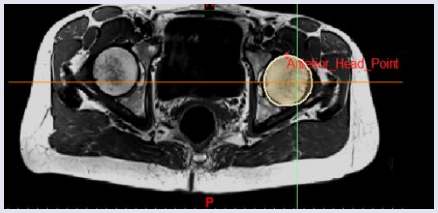
Anatomic landmarks

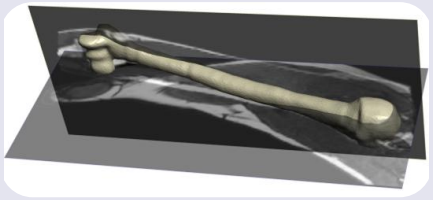
1. Linear Transform

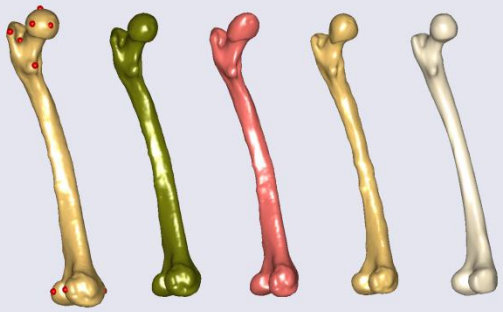
2. Nonlinear Transform RBF

Bone surfaces

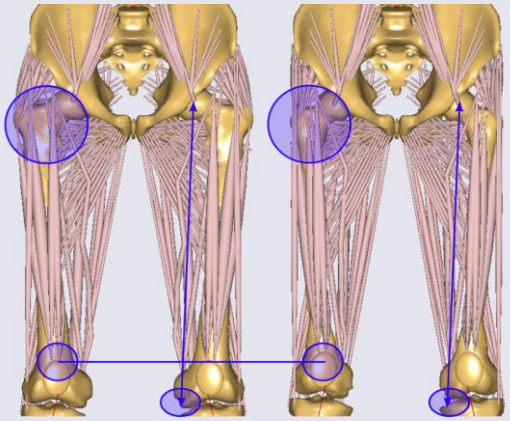
3. Nonlinear Transform STL



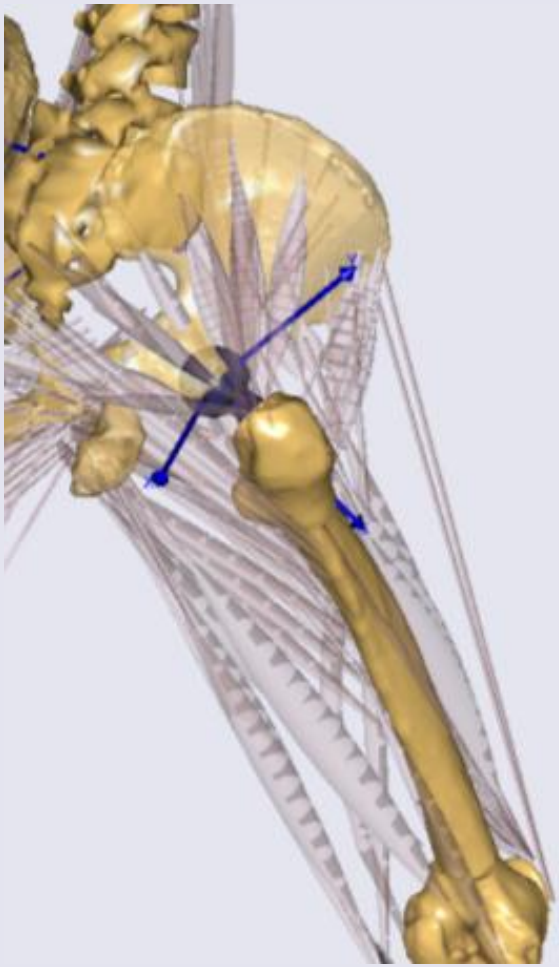


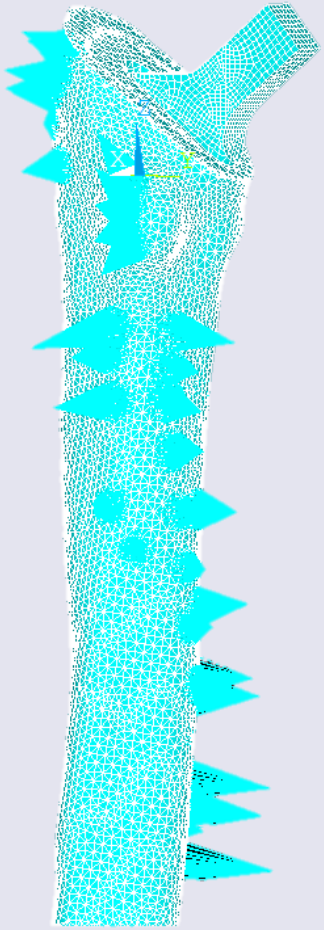


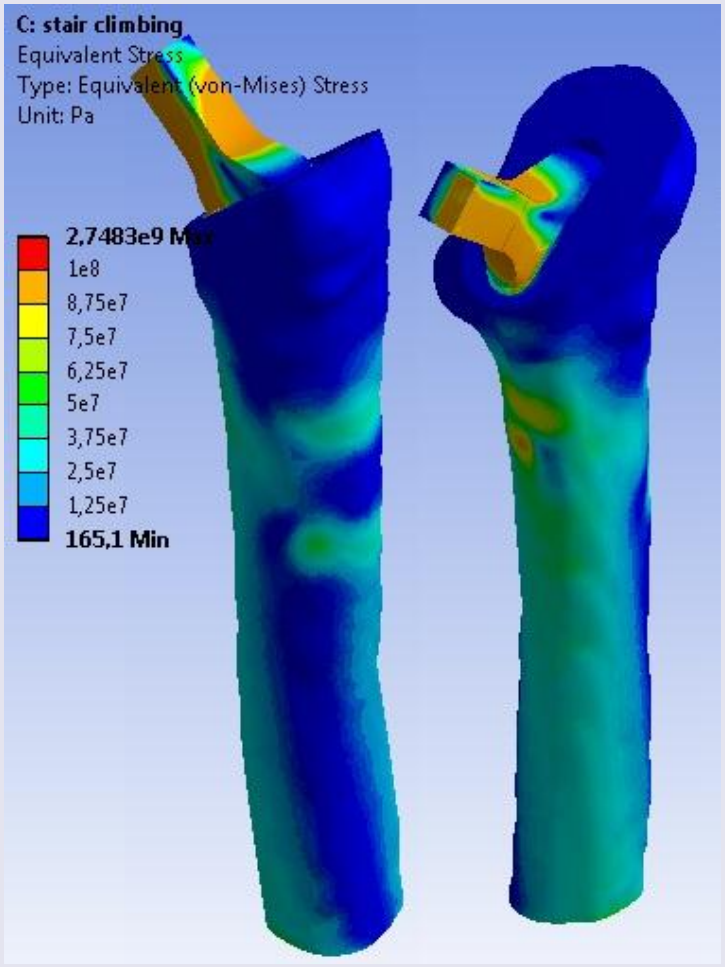
New 5.2: combine 3 methods



Hip Replacements

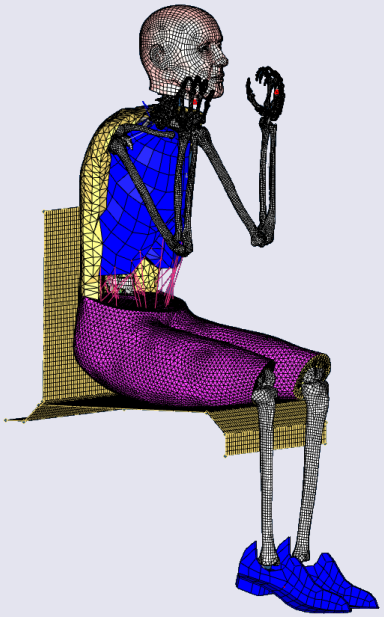




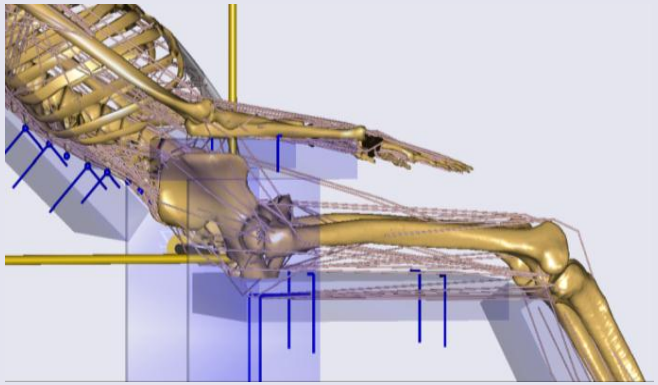


Prof. Dendorfer, AnyBody Tech & University Regensburg

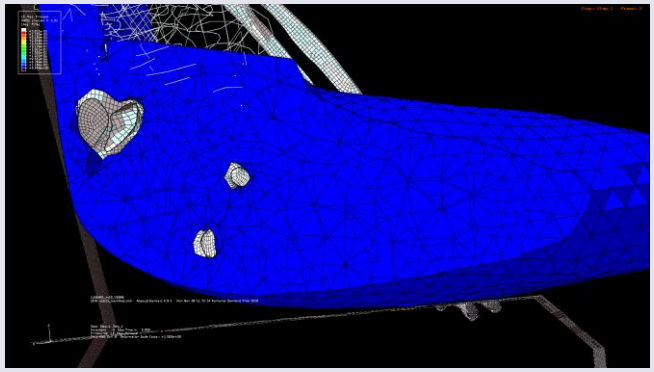
Sitting-acquired deep tissue necrosis



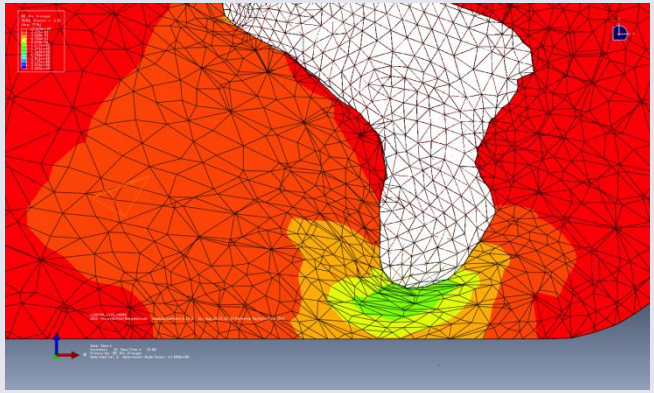
Olesen et al., 2012



AnyBody Seated Human
Boundary conditions



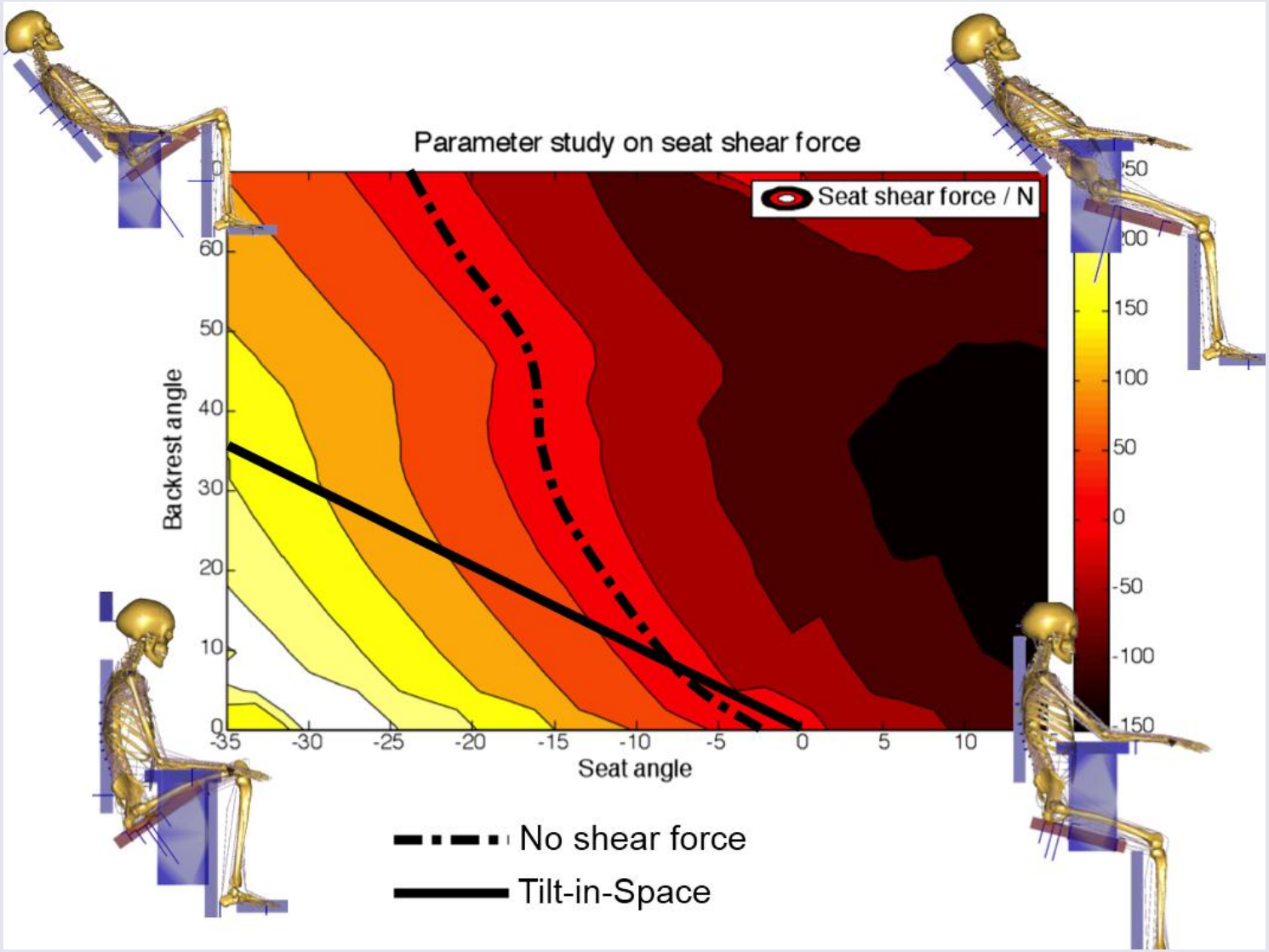
CASIMIR
Non-linear
material & geometry



Abaqus
Buttock strain

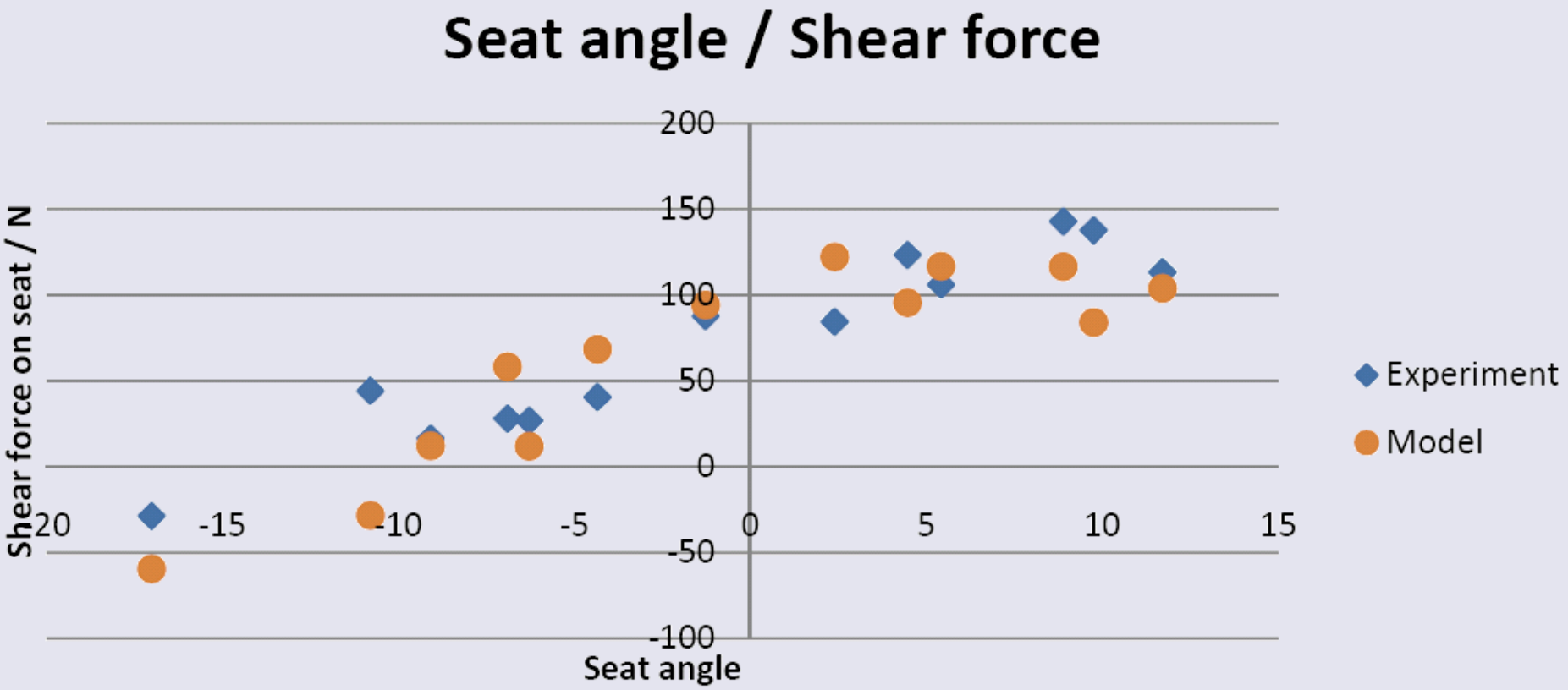
Cell necrosis
Pressure ulcer

Design of intervention



Olesen et al., 2012

Validation



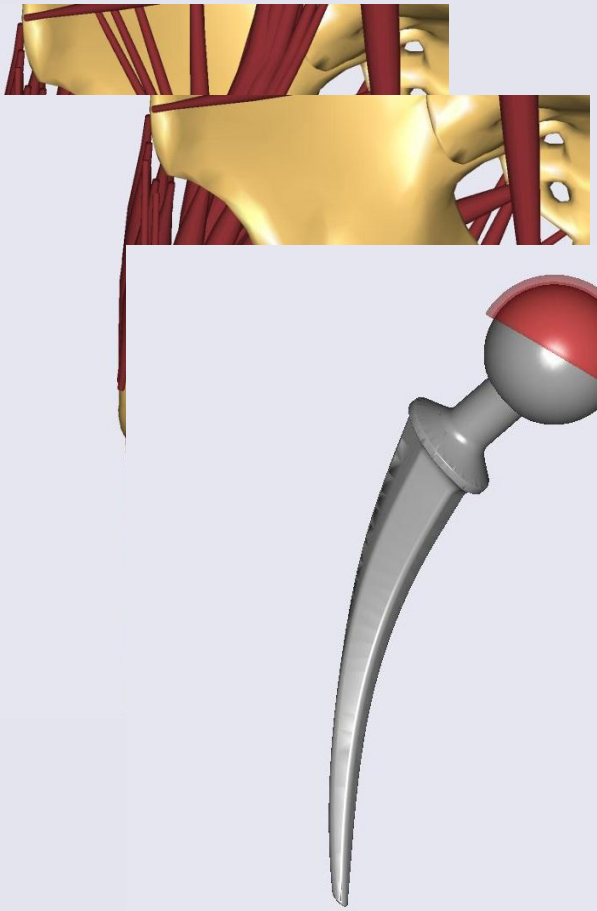
Olesen et al., 2012

Surgical Planning

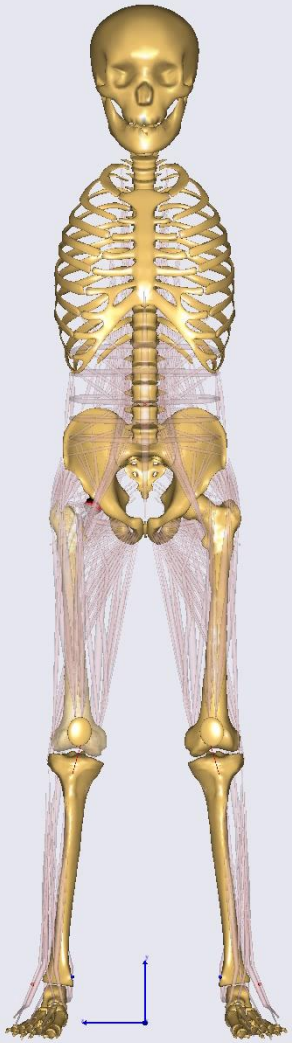
THA-KneeBend Model

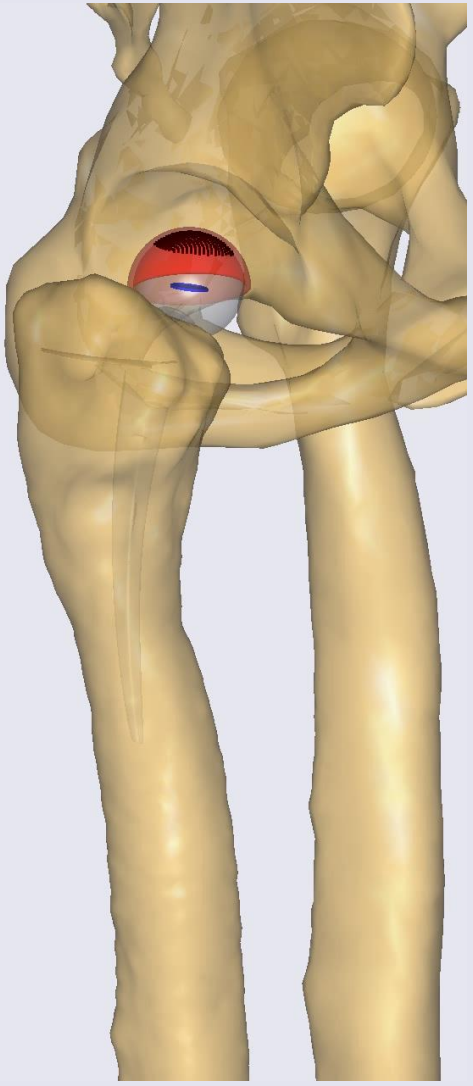
- Exchange of Hip Joint
- Hip as idealised joint or fdk joint
- Widgets for Implant position
- Implants exchangeable

Implant from GrabCAD

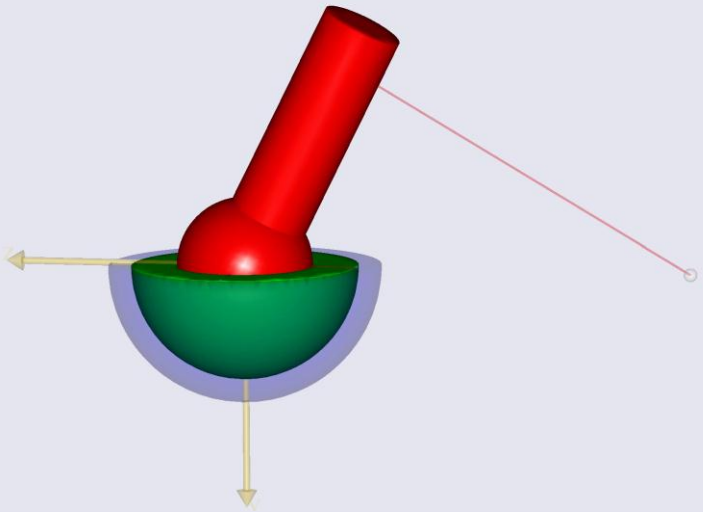


THA-KneeBend Model





Explain FDK & Contact



see previous Webcasts on FDK from:
- John Rasmussen
- Michael S Andersen
- Michael Damsgaard

at *www.anybodytech.com*

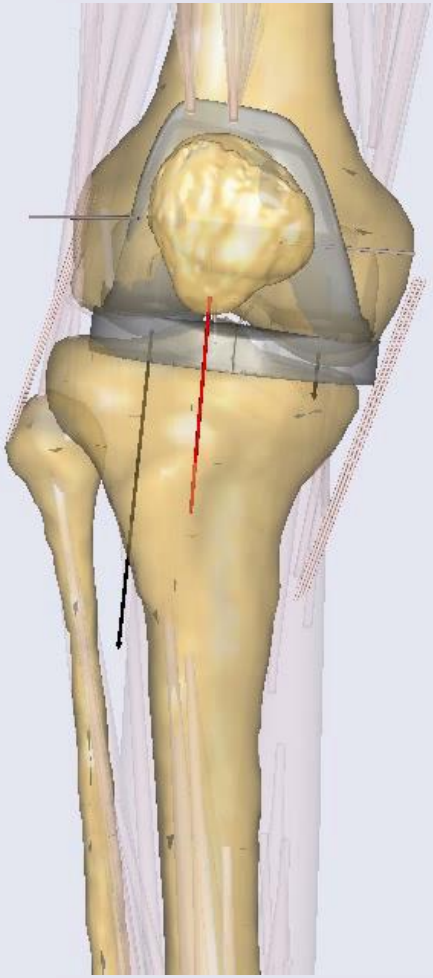
Andersen et al., 2011

see previous Webcasts from:
- Michael S Andersen

at *www.anybodytech.com*

Knee Implant from Grand Challange 1

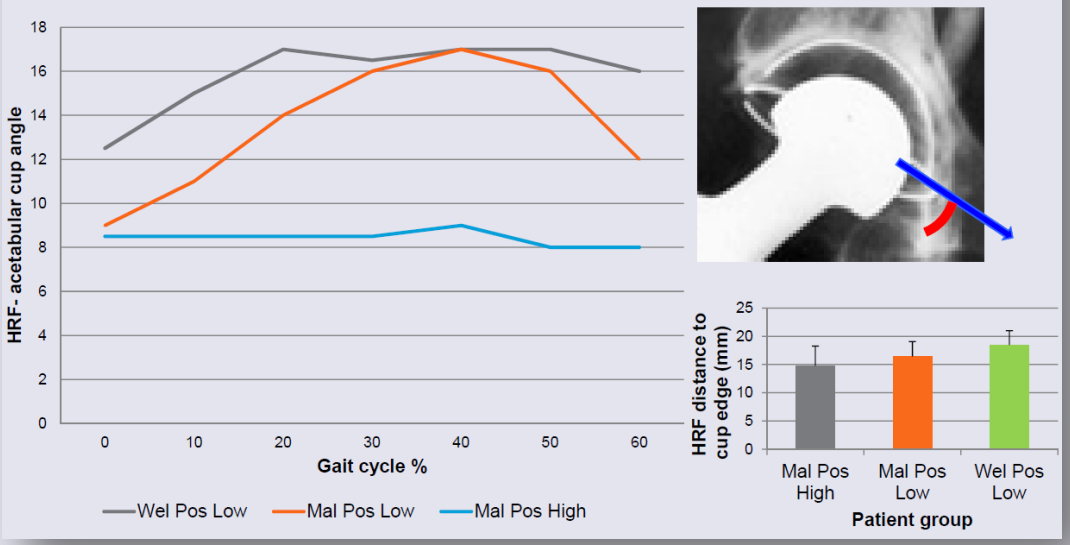
Knee replacement



Andersen et al., 2011

Knee Implant from Grand Challange 1

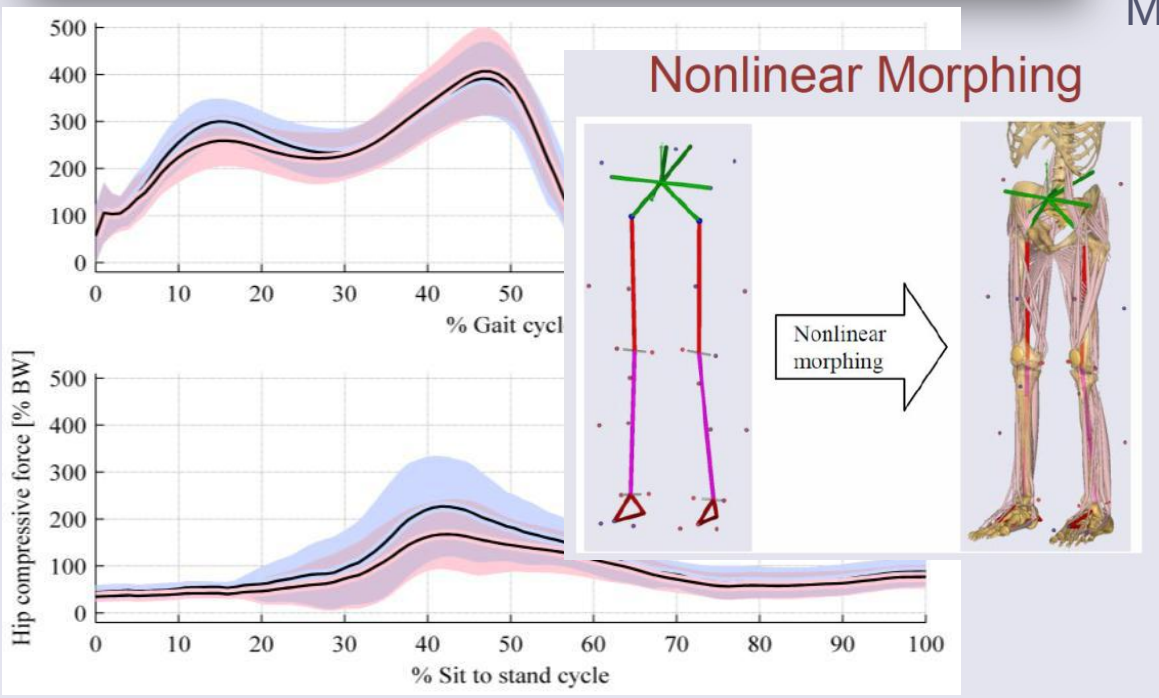
Patient-specific motion analysis



Grammatopolous et al. 2012

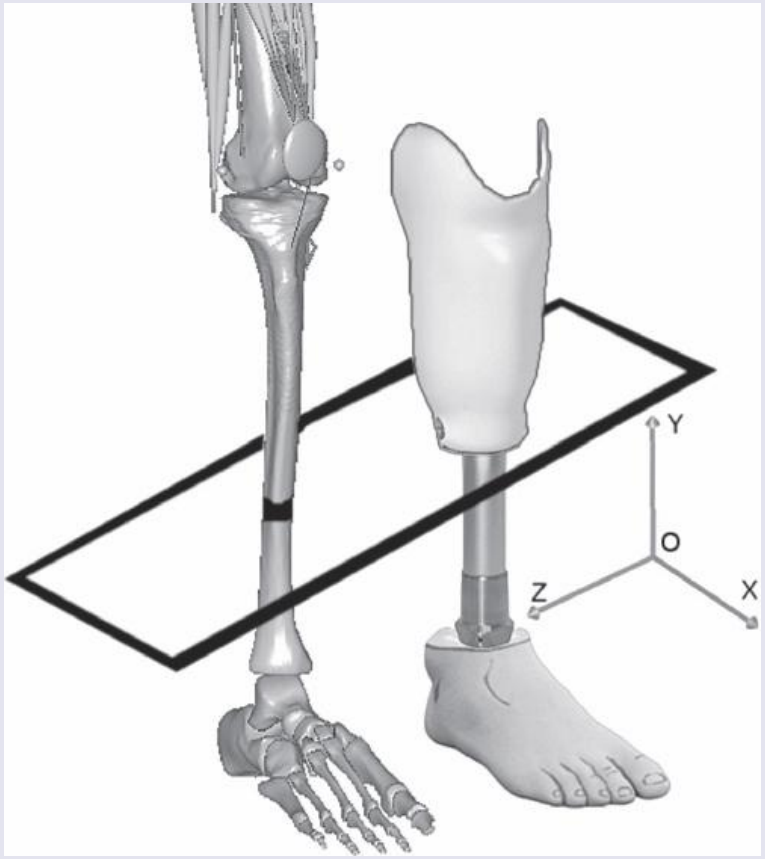
Mellon et al. 2012

Nonlinear Morphing

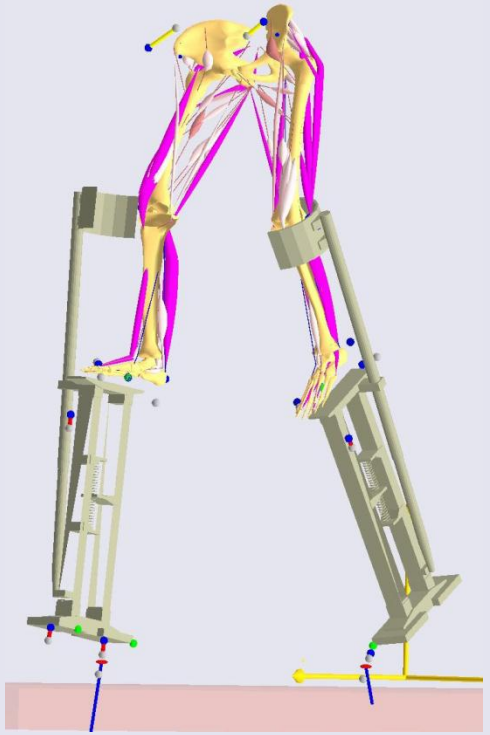


Andersen et al. 2012

Estimation of the forces generated by the thigh muscles for transtibial amputee gait

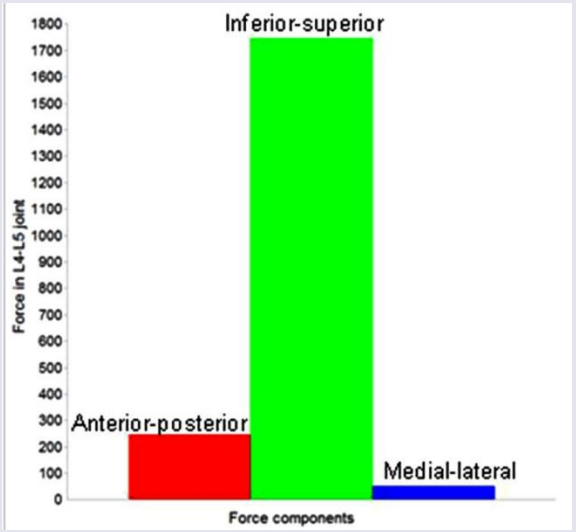


Voinescu et al. 2012

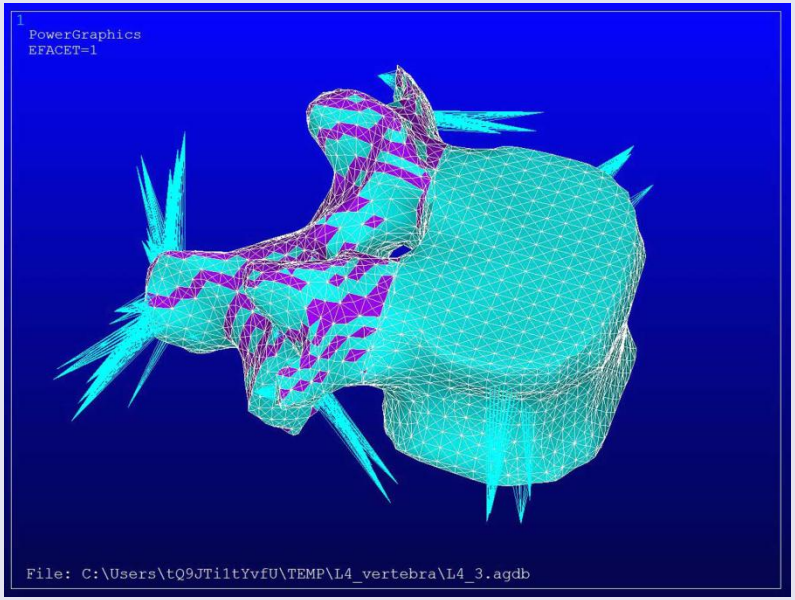


Wu et al. 2009

The Influence of Muscle Forces on the Stress Distribution in the Lumbar Spine

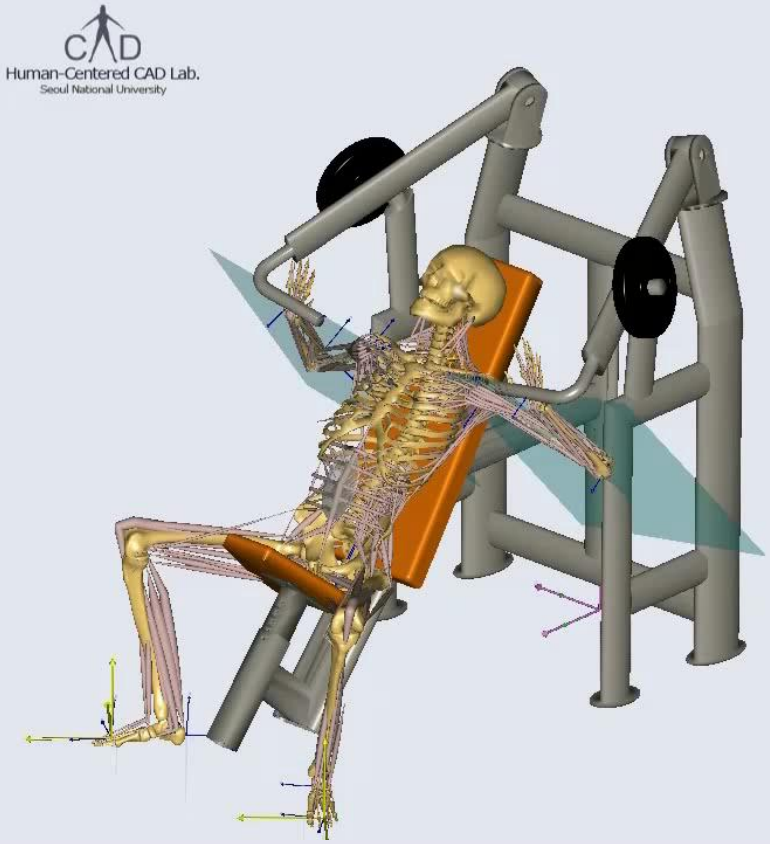


Wong et al. 2011



Future

- **SolidWorks Interface**



Jung et al. ASB 2011

Q & A

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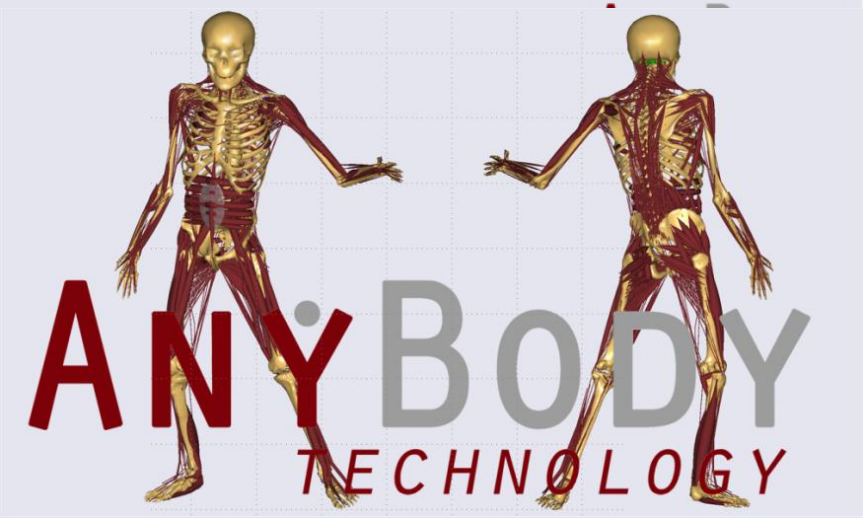
- www.anybodytech.com
- www.anyscript.org



Webcast

- 5th Sept: Orthopedic Applications in the Hip
- 3rd Oct: Orthopedic Applications in the Spine

Meet AnyBuddies at:

- 18-20 July: *3D Analysis of Human Movement*, Bologna, Italy
- 15-18 Aug: *Am. Soc. Biomechanics*, Gainesville, FL
- 13-15 Sep: *ESMAC, Stockholm*, Sweden