

The webcast will start in a few minutes....



# The new AnyBody Modeling System & Musculoskeletal Model Repository

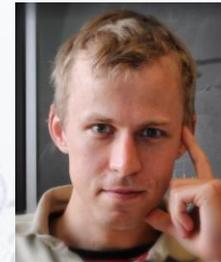
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TOUR AND OVERVIEW OF THE NEW 7.2 VERSION

# Outline

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- General introduction to the modeling system
- New features in the Modeling System
- New Model Repository (AMMR 2.2)
- New help resources and documentation
- Questions and answers



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Sr. R&D Engineer



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R&D Engineer, Ph.D

# Control Panel

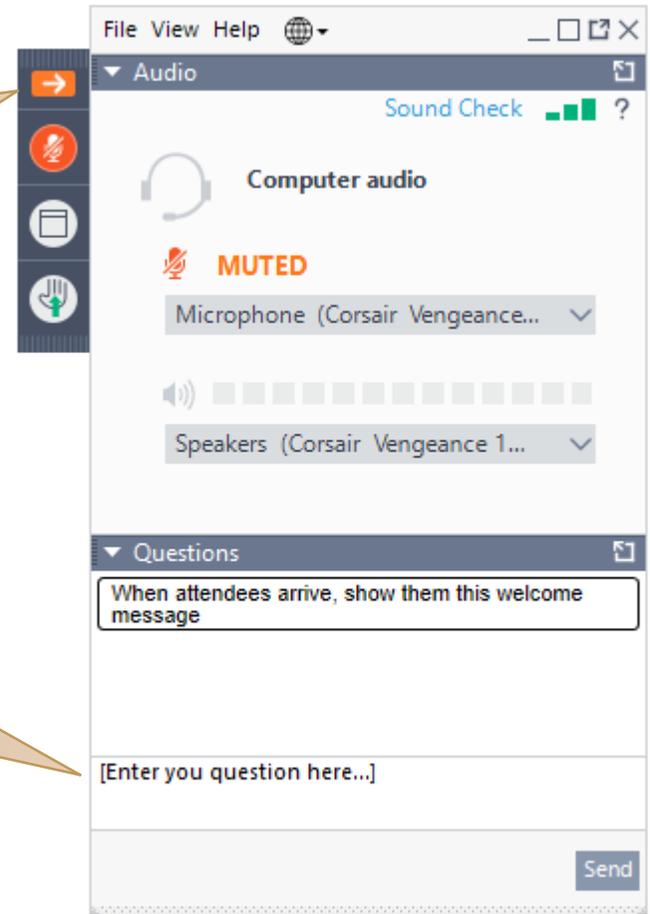
The Control Panel appears on the right side of your screen.

Submit questions and comments via the Questions panel.

*Questions will be addressed at the end of the presentation. If your question is not addressed we will do so by email.*

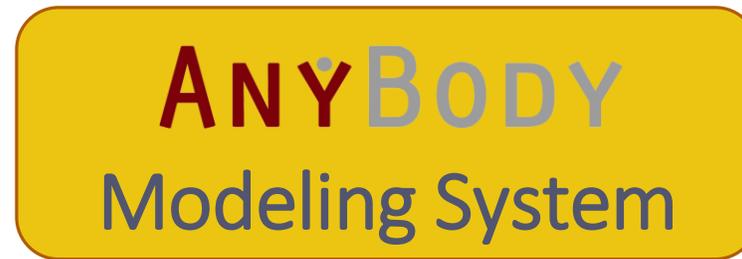
Expand/Collapse the Control Panel

Ask a question during the presentation



## Musculoskeletal Simulation

Motion data  
Kinematics + Forces



Body Loads

- Joint moments
- Muscle forces
- Joint reaction forces



Movement  
Analysis

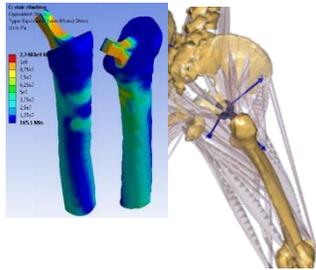


Product Design  
Optimization



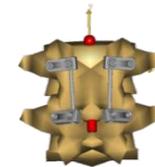
Ergonomic  
Analysis

# ANYBODY Modeling System

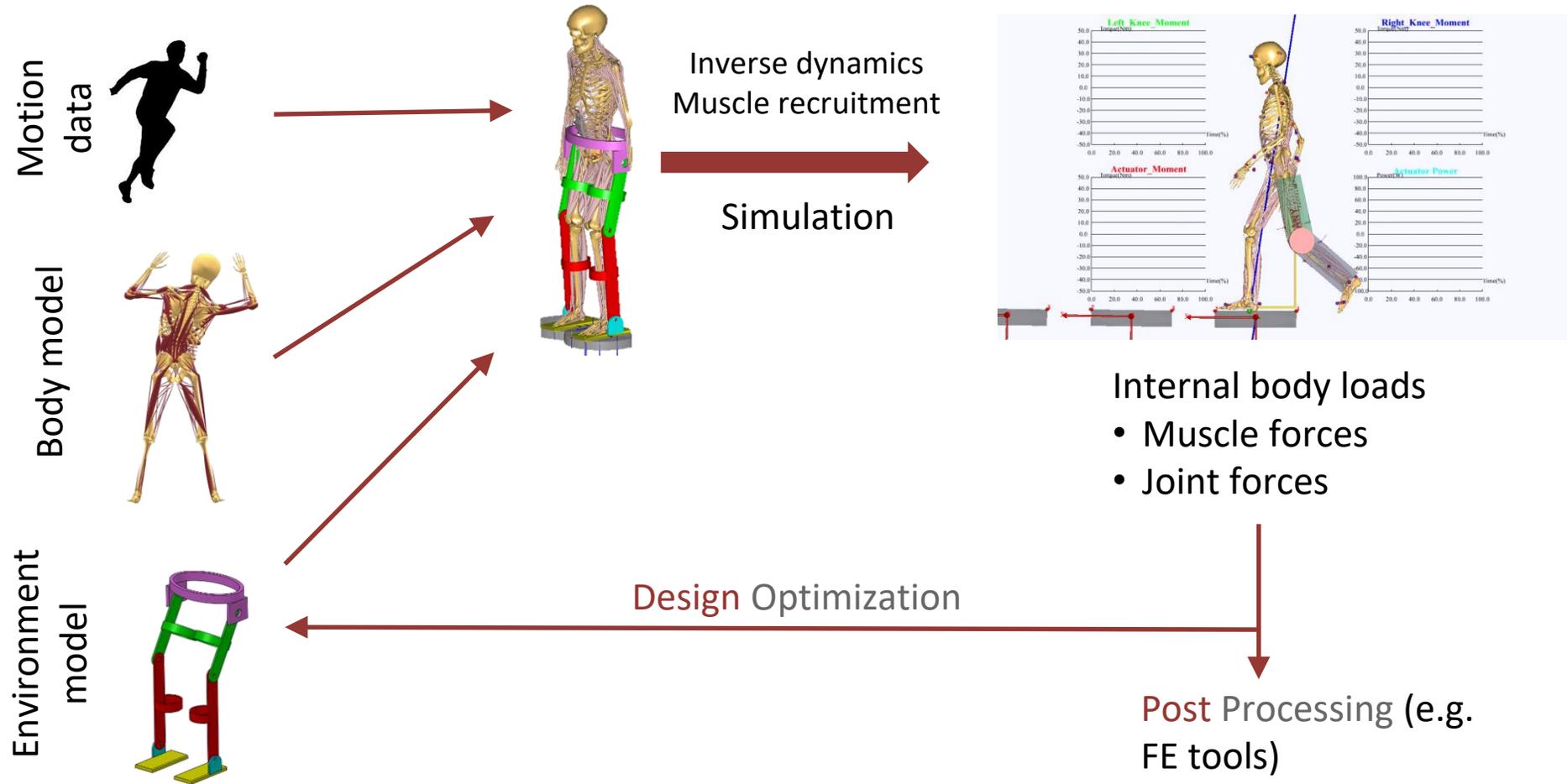


Load Cases for  
Finite Element  
Analysis

Surgical Planning and  
Outcome Evaluation

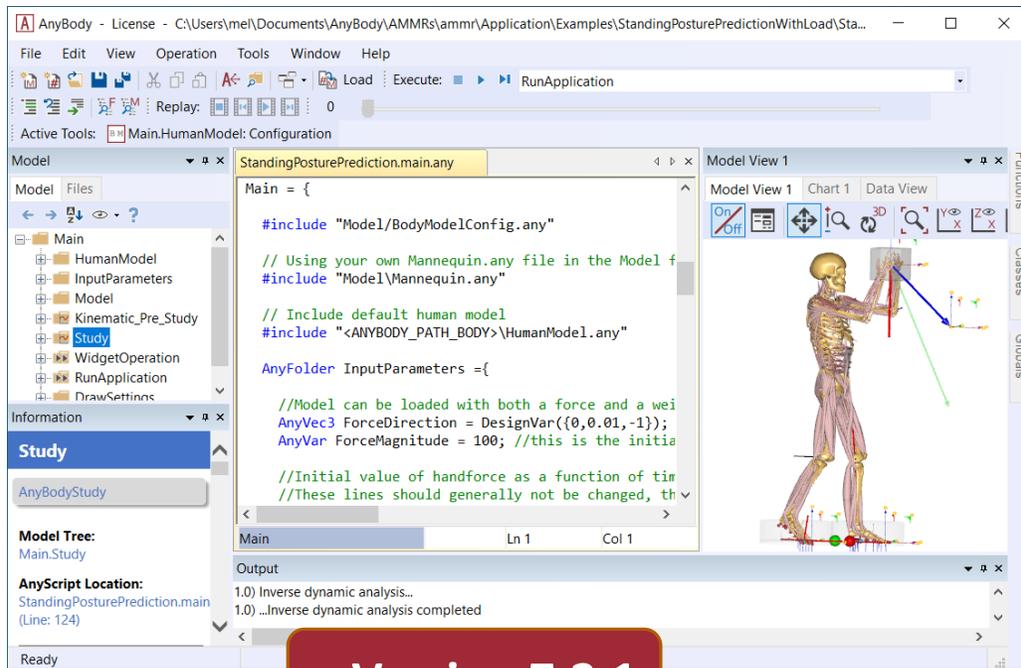


# AnyBody Modeling System



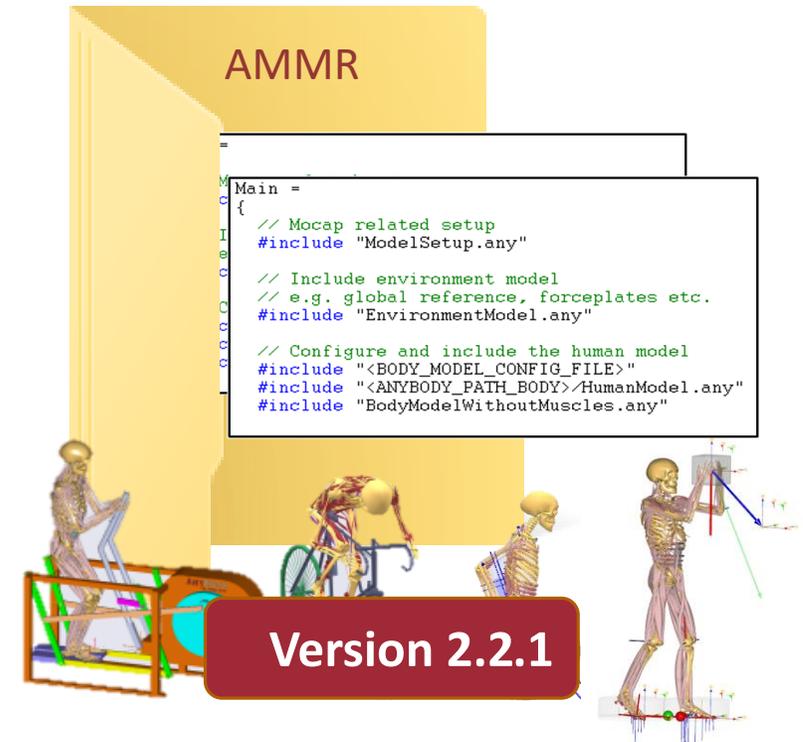
# AnyBody Modeling System

## ANYBODY Modeling System



**Version 7.2.1**

## Model Repository



**Version 2.2.1**

# How to get the new version

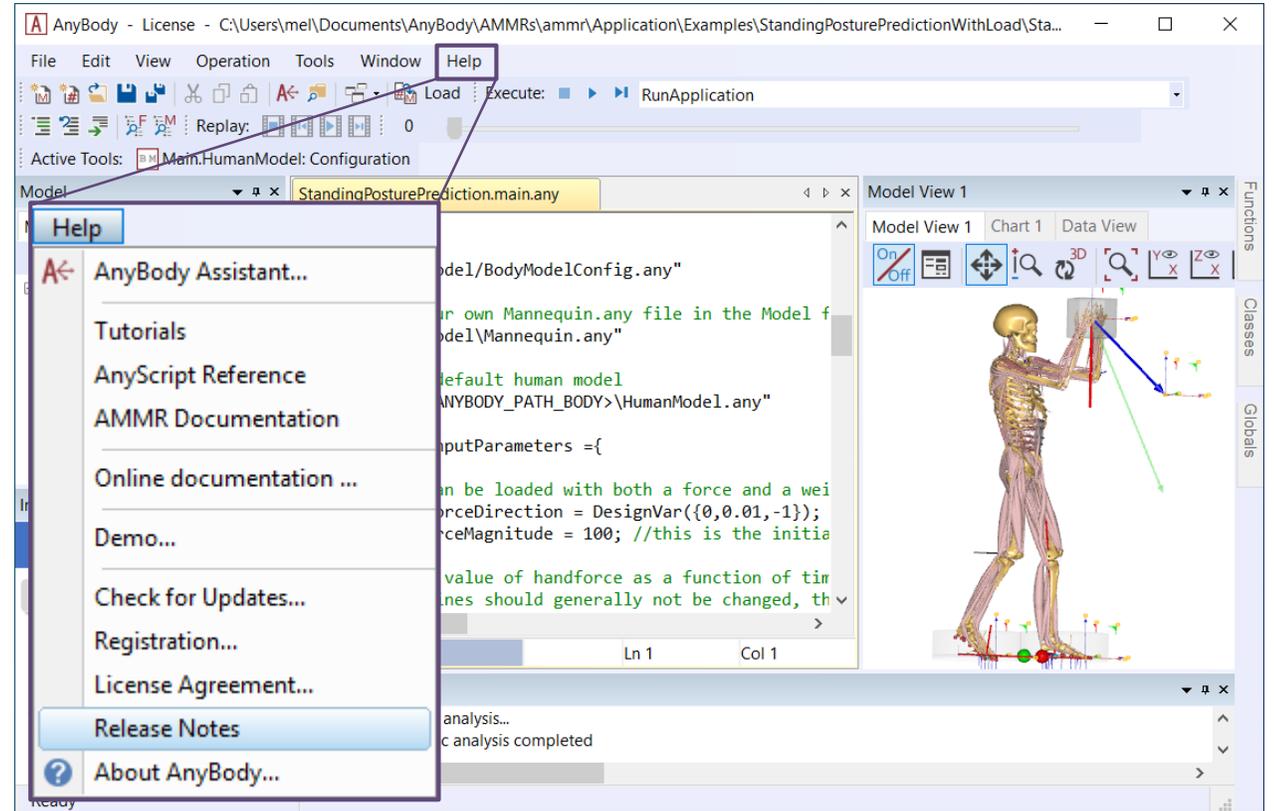
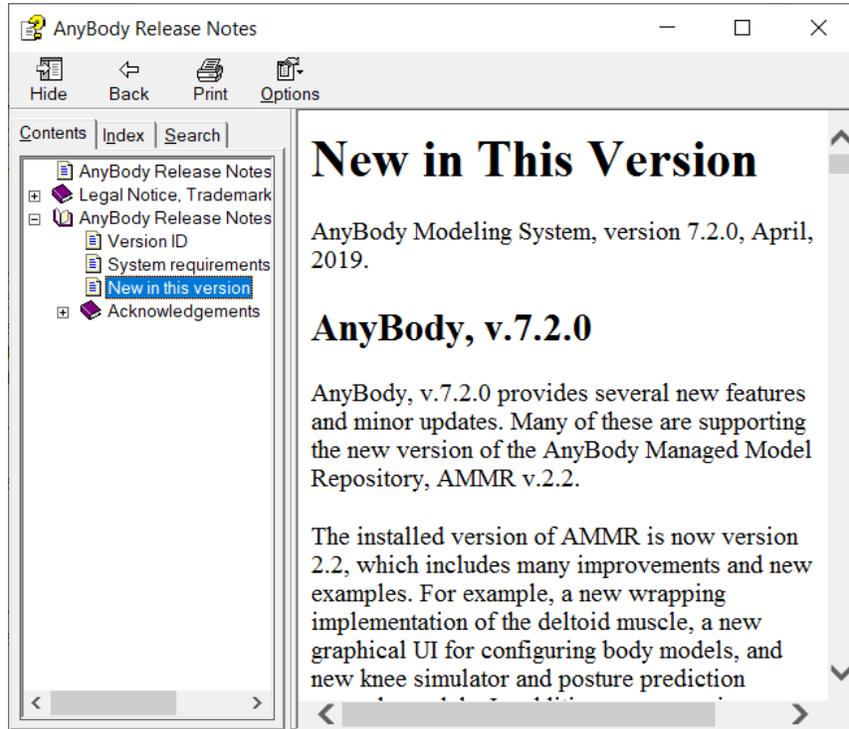
The screenshot shows a web browser window with the URL `://www.anybodytech.com/downloads/customer-downloads/?no_cache=1`. The page title is "AnyBody Modeling System" and the content says "Download installers for the AnyBody Modeling System here." Below this, there is a table of download links:

Version	Size	Release Date	Download Link
<b>AnyBody Modeling System (64-bit version)</b> v. 7.2.0.6876	792M	2019.04.07	Download Download mirror (faster outside Europe) Install Guide
<b>AnyBody Modeling System (64-bit version)</b> v. 7.1.2.6044	479M	2018.06.13	Download Download mirror (faster outside Europe) Install Guide

Note: Organizations with floating licenses must run V12 or higher of the RLM license server (available below).

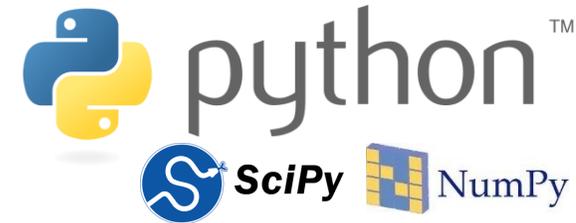
An orange arrow points to the "Download" link for the 7.2.0.6876 version.

# What is new?

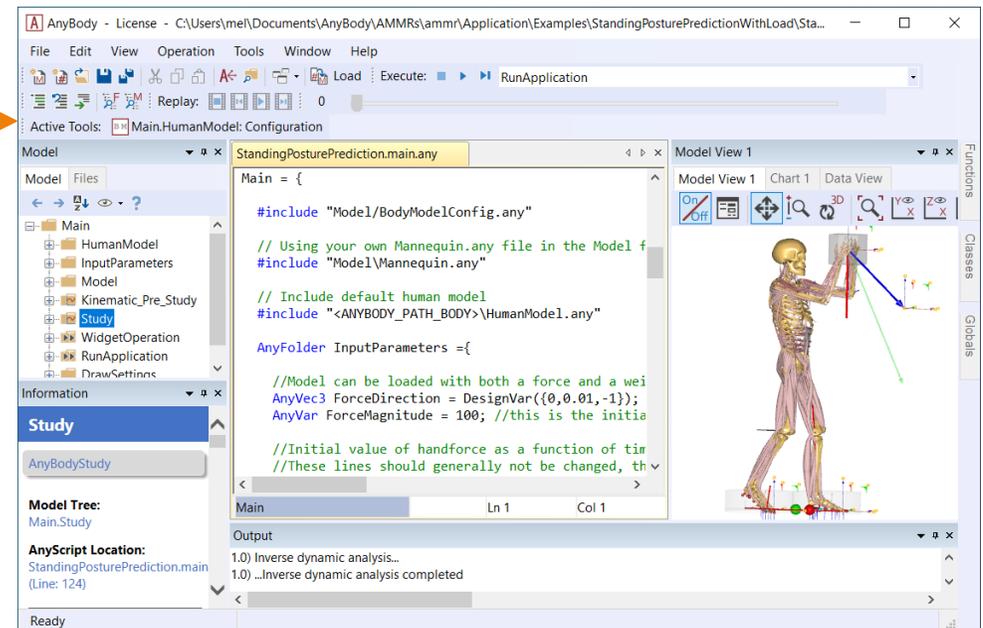


# New in the Modeling System...

- New system for model plugins
- Built-in Python distribution



- New toolbar with plugins
- Belongs to the model
- Plugins are small Python applications



# New Metabolism models

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- What is it? -> A way to sum the energy expenditure
- Two new classes :
  - [AnyMetabModelU](#)
  - [AnyMetabModelB](#)
- Studies may specify a default **AnyMetabModel**
  - or controlled by individual muscles
- Umberger et al. 2003<sup>1</sup> and 2010<sup>2</sup>
- Bhargava et al. 2004<sup>3</sup>

<sup>1</sup> Umberger, B. R., Gerritsen, K. G., & Martin, P. E. (2003). A model of human muscle energy expenditure. *Computer methods in biomechanics and biomedical engineering*, 6(2), 99-111.

<sup>2</sup> Umberger, B. R. (2010). Stance and swing phase costs in human walking. *Journal of the Royal Society Interface*, 7(50), 1329-1340.

<sup>3</sup> Bhargava, L. J., Pandy, M. G., & Anderson, F. C. (2004). A phenomenological model for estimating metabolic energy consumption in muscle contraction. *Journal of Biomechanics*, 37(1), 81-88.

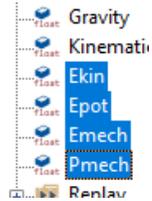
**Work in progress...** Ready for academia and researchers



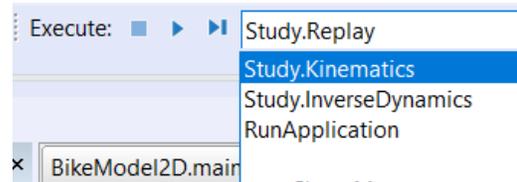
**Contact us!** If this is your research area...

# Other improvements

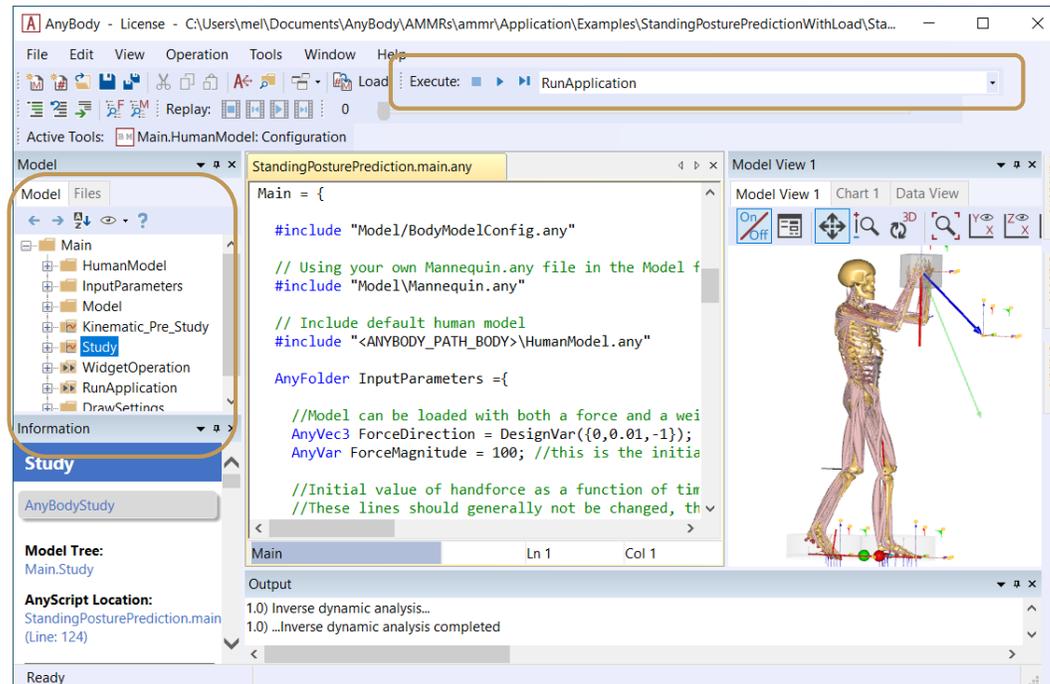
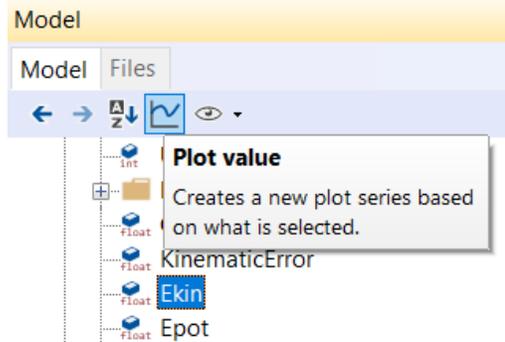
## Multi selection in model tree



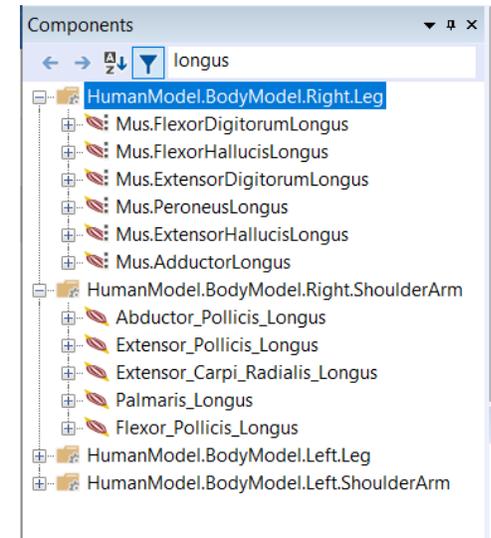
## Improved operation control



## Plot directly from model tree



## New: Component based view of the model with search...



Experimental

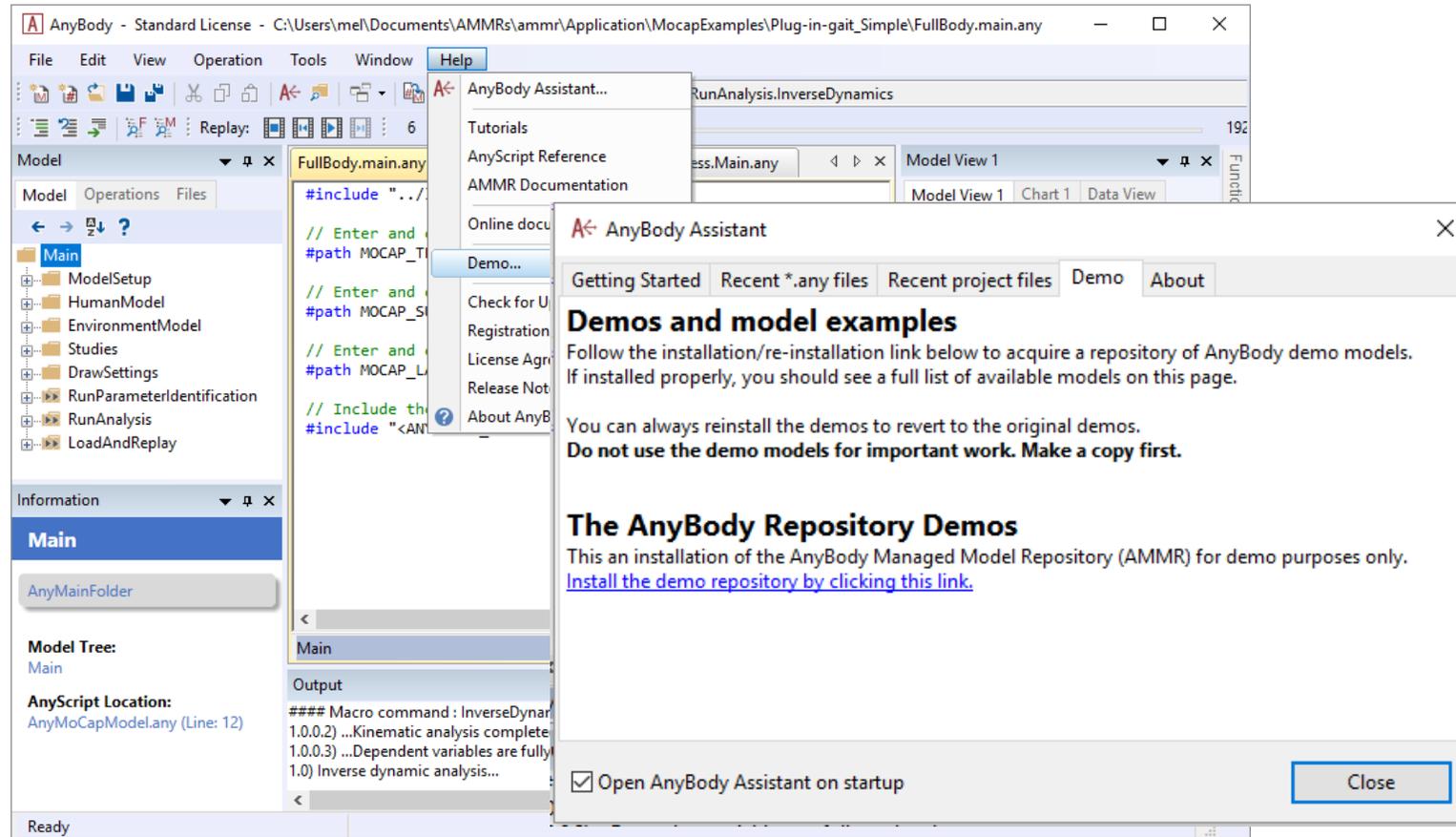
# Model Repository

- Updated body models
  - New deltoid implementation
  - New scapula-thorax contact mechanism.
  - Many improvements and fixes
  
- New BodyModel configuration plugin
  
- New model examples
  - Knee simulator
  - Standing model template
  - Standing posture prediction model

## AnyBody Managed Model Repository



# How do I get the new Model Repository?

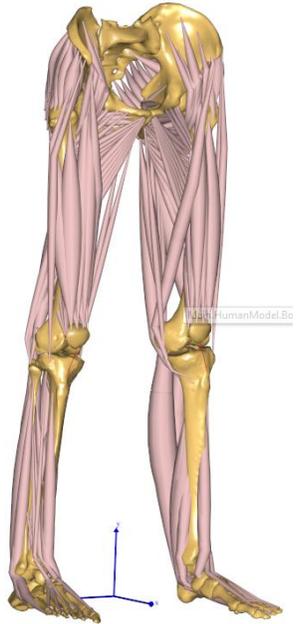


# What is new?

anyscript.org/ammr-doc

**Caution:** The default leg model has changed in AMMR 2.2 (from TLEM1 to TLEM2). To force the old leg model use:

```
#define BM_LEG_MODEL _LEG_MODEL_TLEM1_
```



The screenshot shows the 'Changelog' page for AMMR 2.2.1 (2019-05-13). The page includes a navigation bar with 'previous', 'next', 'toc', and 'index' buttons. The main content area features a 'Caution' box with the same text as the slide, followed by a blue header for 'AMMR 2.2.1 (2019-05-13)' and a 'Fixed:' section with a list of updates. A sidebar on the left contains a search bar and a 'Table of Contents' with links to 'About the AMMR' and 'Changelog'.

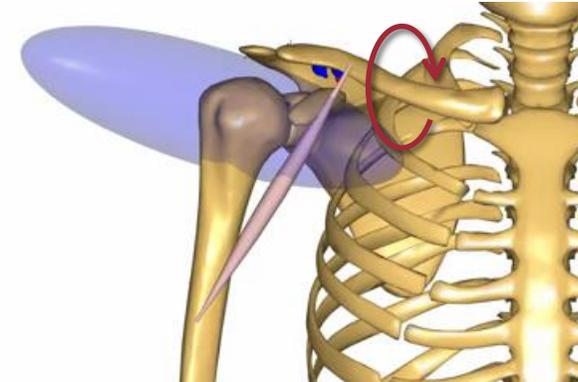
About the AMMR  
► Changelog

# Shoulder improvements

- New deltoid wrapping implementation
  - The work of Marta Strzelczak from ETS in Montreal [Strzelczak et al. (2018)]
  - Old implementation can be enabled with:
- Rhythm to control Sterno clavicular axial rotation
- New scapula-thorax kinematics
  - Still testing -> must be enabled explicitly.
  - Solves problem when ribs becomes individual segments.

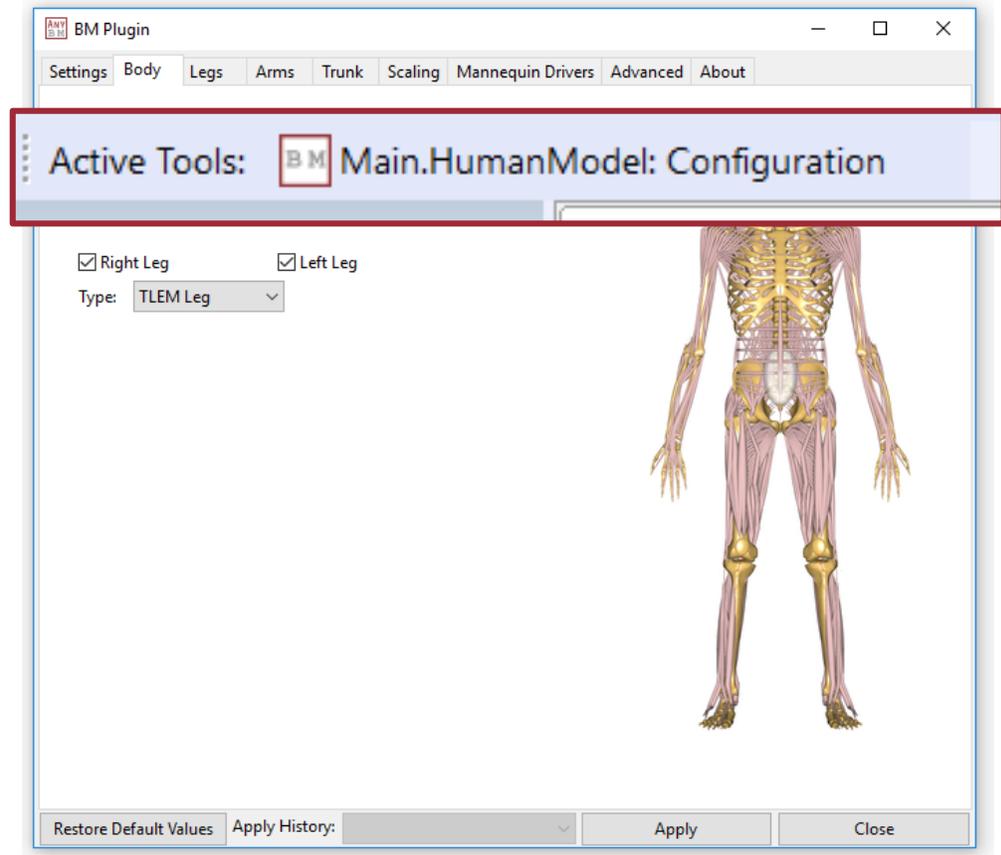
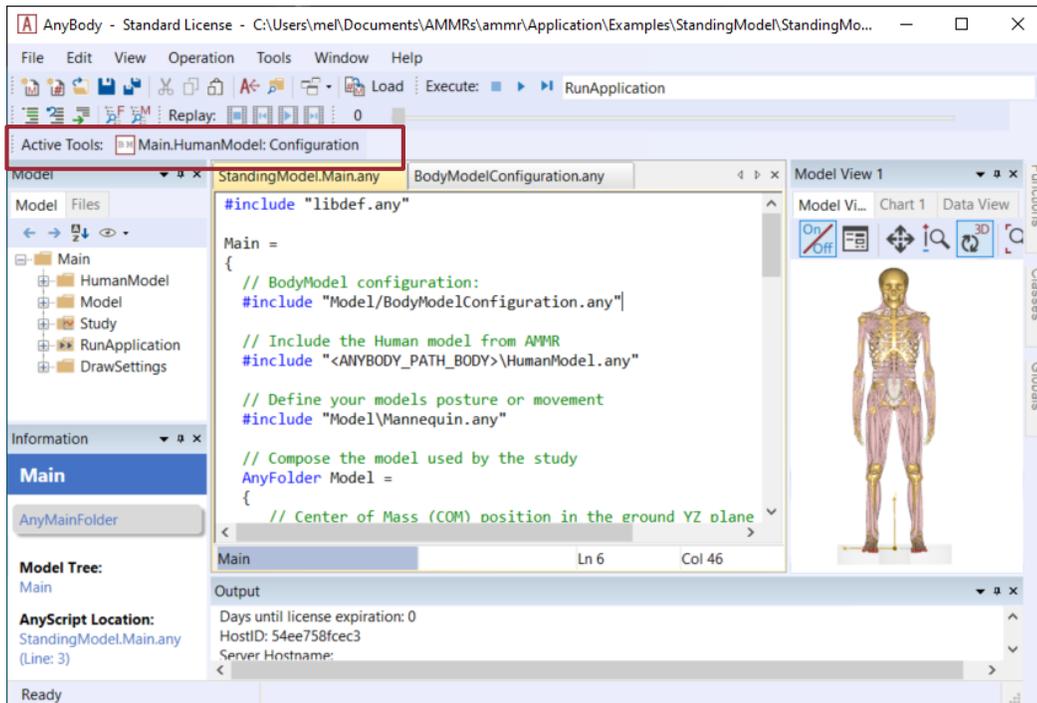
```
#define BM_ARM_DELTOID_WRAPPING OFF
```

```
#define BM_ARM_THORAX_SCAPULA_CONTACT _MULTIPLE_POINT_CONTACT_
```



Strzelczak, M., Lund, M. E., Sins, L., Mickael, B. & Hagemeister, N. A new wrapping approach for the deltoid muscle modelling. in The Proceedings of the 20th Biennial Meeting of the Canadian Society for Biomechanics (2018).

# BodyModel Configuration plugin



# New Model Examples:

anyscript.org/ammr-doc

AMMR v2.2.1-beta Documentation > [previous](#) [next](#) [toc](#) [index](#)

**ANY**  
MODEL REPOSITORY

Quick search  [Go](#)

Table of Contents

- Welcome to the AMMR documentation!
- Getting Started with AMMR
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- The Body Models
- Application Examples
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  - Motion Capture and gait analysis
  - Orthopedics and rehab
  - Other examples
  - Sports
  - Validation
- Creating a Human model from scratch
- Introduction to Scaling
- The AnyMoCap Framework
- About the AMMR

## Application Examples

In the repository, you can find musculoskeletal applications from a wide area of interests. These models are from various AnyBody users, and all demonstrate features from the AnyBody Modeling System.

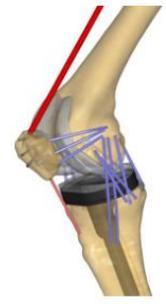
**Note:** All examples are powerful computational models where variables of interest have been biomechanically checked to make sense. However, when modifying or using models for other purposes results may occur that cannot be interpreted by anatomical or physiological considerations.

### Daily activities and ergonomics

A grid of 12 small thumbnail images representing different human models in various postures and activities. The thumbnails are arranged in three rows and four columns. The thumbnails are: Row 1: Squat, Hand crank model, Pedel demo simple, Standing Model (highlighted with a red border); Row 2: Seated Human, Lifting Model; Row 3: Airline passenger, Pedel demo, Free posture Models.



Standing Model



Knee Simulator Model

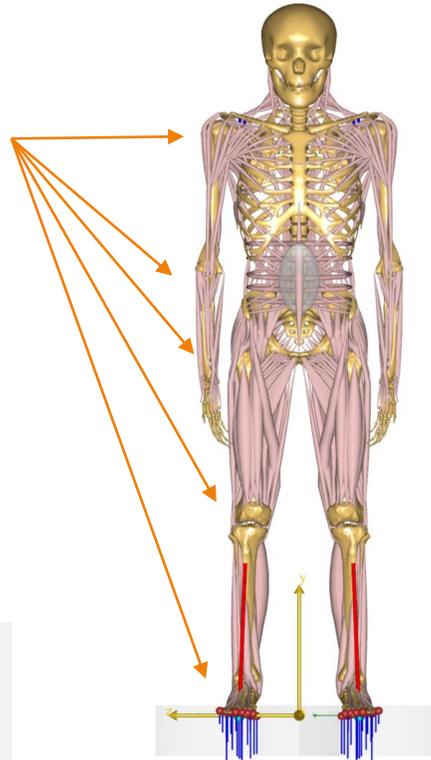


Posture Prediction Model

# Updated Standing Model

## Easy to configure

**Posture controlled by soft Mannequin drivers**



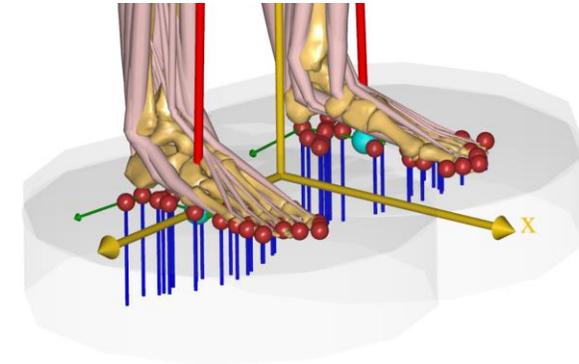
**Center of Mass balance driver**

```
// Center of Mass (COM) position
// COM balance driver can be excluded with:
// #define EXCLUDE_COM_BALANCE_DRIVERS
AnyVector CenterOfMassXZ = {0,0};
```

## Easy control of foot position

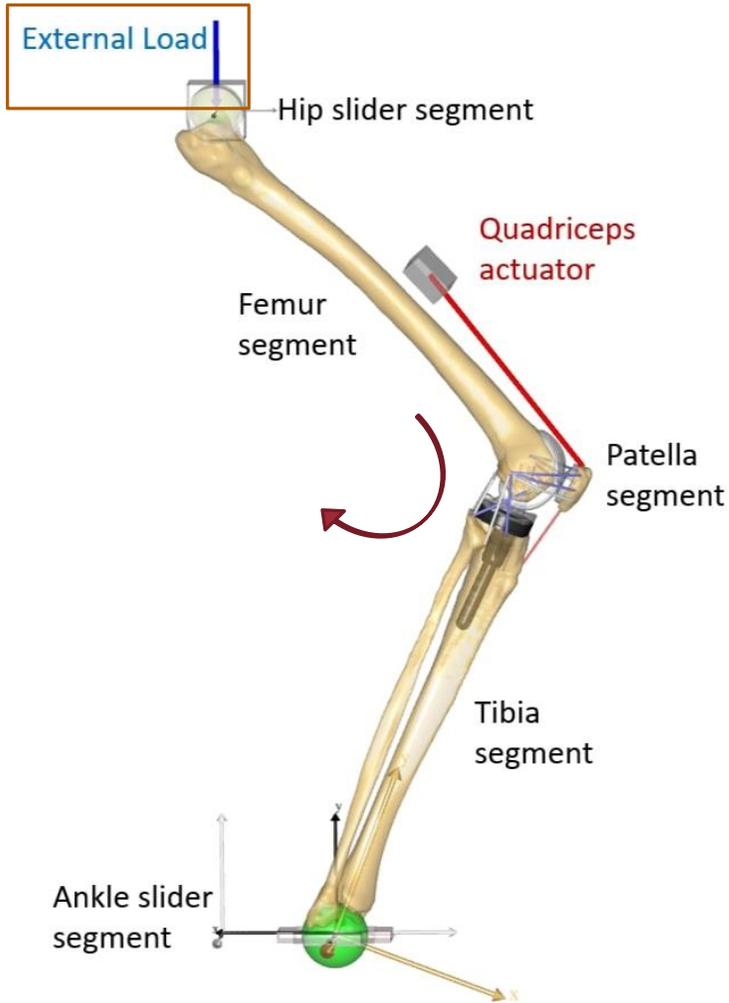
```
// Positioning of the right and left feet.
// Ground-foot constraints can be excluded with:
// #define EXCLUDE_FOOT_CONSTRAINTS
Environment.GlobalRef.RightFootPrint = {
  AnyVec3 HeelPosition = {-0.08, 0, 0.14};
  AnyVec3 ToeDirection = {1, 0, 0.1};
};
```

## Full Ground reaction Force Prediction



# New Knee simulator example

**\*\*Long Run Time\*\***



## User defined settings

- 6th Grand Challenge dataset + Kansas knee simulator
 

```
#define DEF_KNEE_FLEXION_MIN 0
#define DEF_KNEE_FLEXION_MAX 60

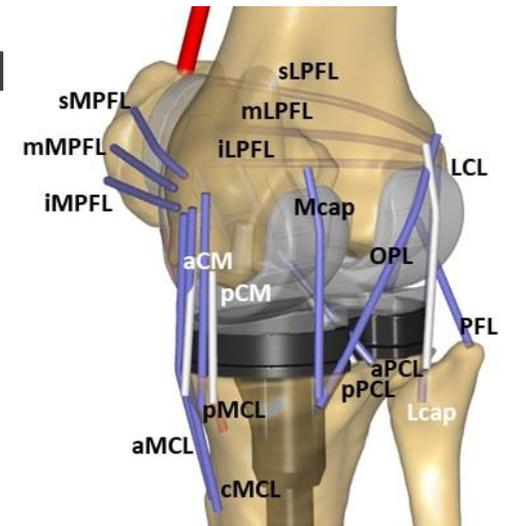
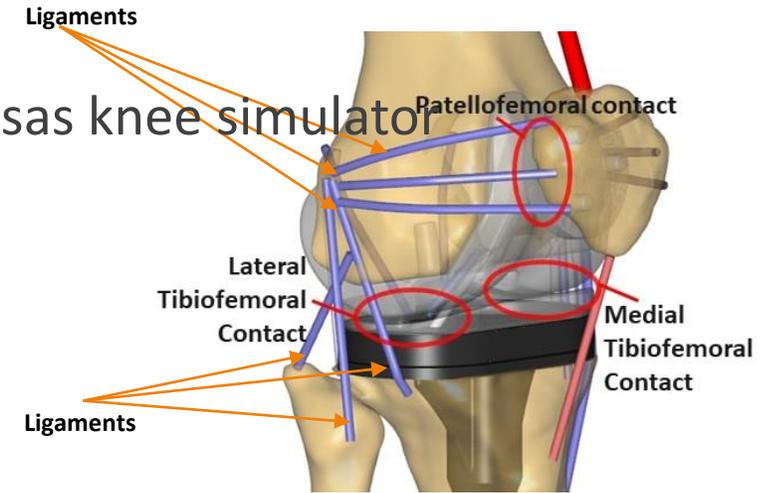
#define DEF_HIP_AXIAL_LOAD_MIN 200
#define DEF_HIP_AXIAL_LOAD_MAX 200

#include "Input/Ligament_Properties.any"
```

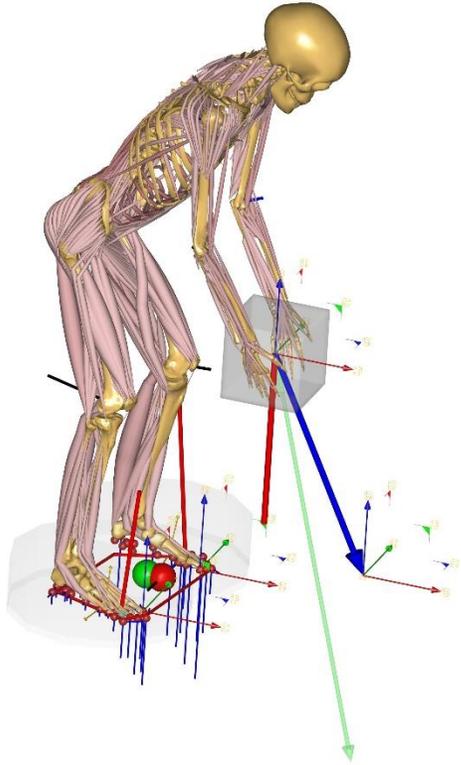
- Ligament bundle properties
 

```
//stiffness (k_) in Newtons [N] and
//reference strains (er_)
```

- Movement governed by:
  - Contact surfaces
  - ligament structures



# New Standing posture prediction



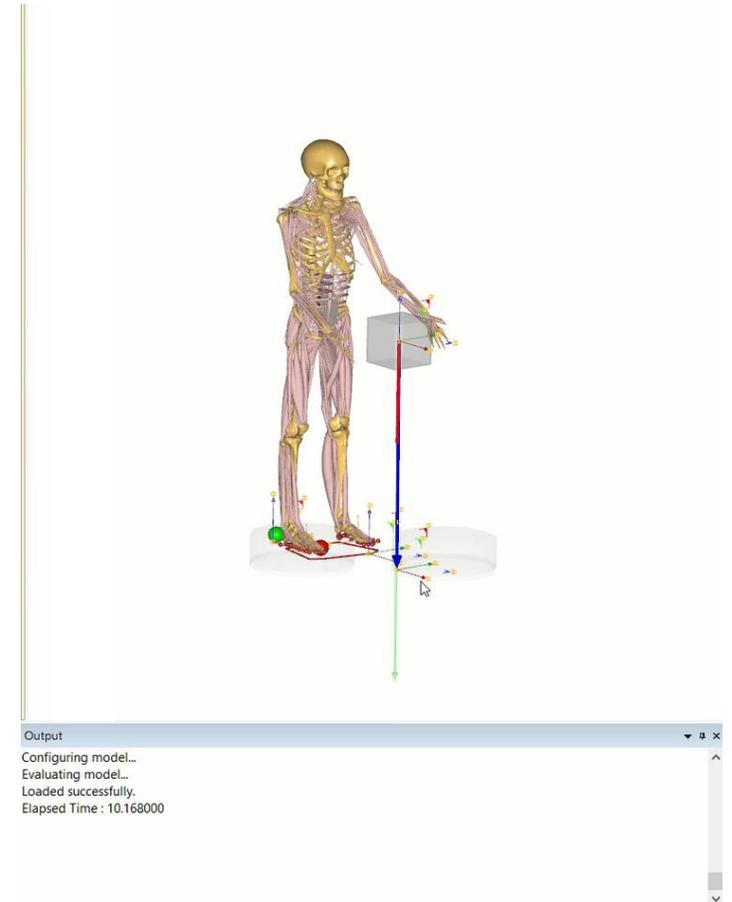
- Predicts posture based on external loads
- Fixed object weight or force vector

```
AnyVar ObjectWeight = 0;
```

```
#define LoadInRightHand 1
```

```
#define LoadInLeftHand 1
```

- Load model, click/drag widgets, release to run analysis:
  - Minimize joint torques
  - Balance drivers (keep CoP within foot stance area)

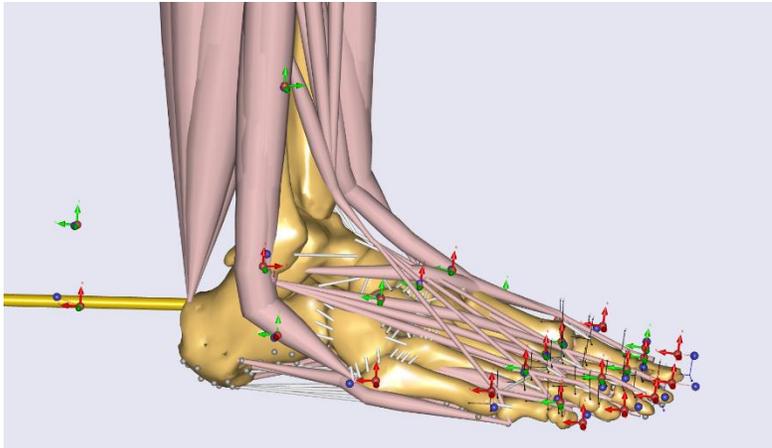


\* Please note the speed of the video was increased for viewing purposes.

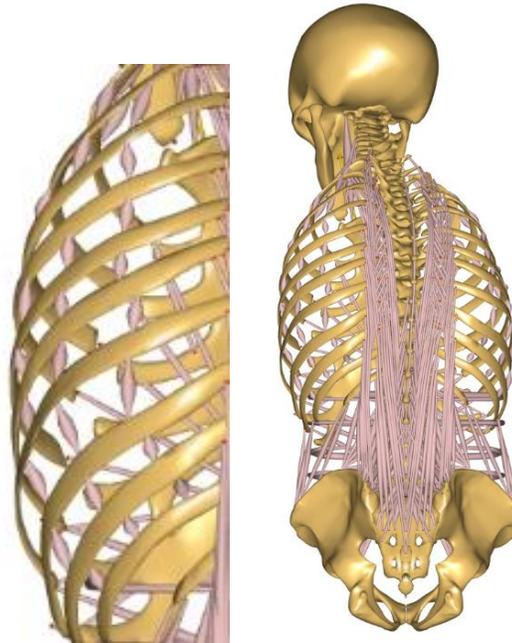
# What can you expect in 2019?

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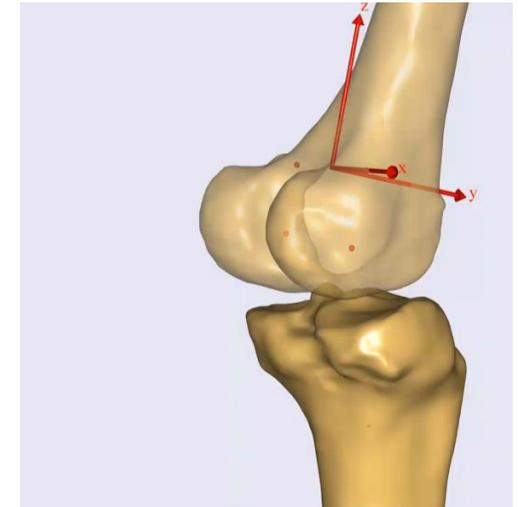
**Updated Glasgow-Maastricht Foot Model  
with MoCap**



**Thoracic model**



**Moving axis knee Addon**



# Teaser: Moving-Axis Knee model



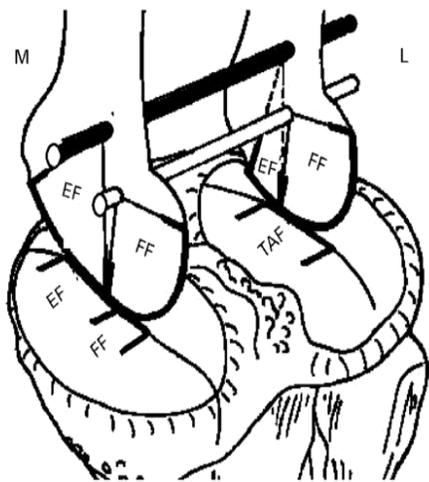
Development and validation of a subject-specific moving-axis tibiofemoral joint model using MRI and EOS imaging during a quasi-static lunge

C.M. Dzialo<sup>a,\*</sup>, P.H. Pedersen<sup>b</sup>, C.W. Simonsen<sup>c</sup>, K.K. Jensen<sup>c</sup>, M. de Zee<sup>d</sup>, M.S. Andersen<sup>a</sup>

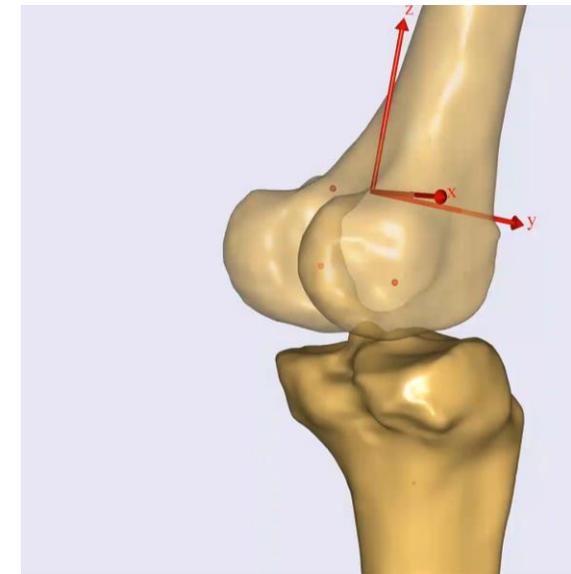
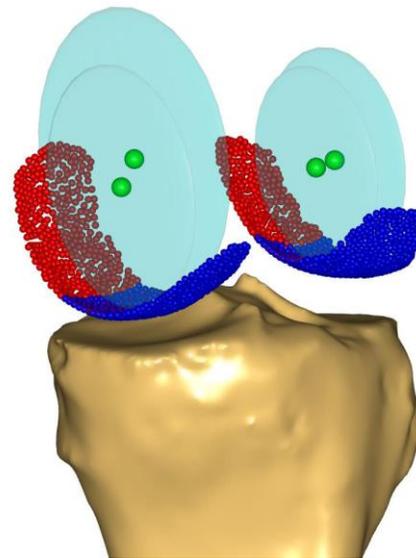
<sup>a</sup> Department of Materials and Production, Aalborg University, Fibigerstræde 16, DK-9220 Aalborg, Denmark  
<sup>b</sup> Department of Orthopedic Surgery, Aalborg University Hospital, Høbrovej 18-22, DK-9000 Aalborg, Denmark  
<sup>c</sup> Department of Radiology, Aalborg University Hospital, Høbrovej 18-22, DK-9000 Aalborg, Denmark  
<sup>d</sup> Department of Health Science and Technology, Aalborg University, Fredrik Bajers Vej 7D, DK-9220 Aalborg, Denmark

```
//---Insert the following before <ANYMOCAP_MODEL>-----
// Define right/left/both knee joints
#define BM_JOINT_TYPE_KNEE_RIGHT _JOINT_TYPE_USERDEFINED_
#define BM_JOINT_TYPE_KNEE_LEFT _JOINT_TYPE_USERDEFINED_

// Include Moving-axis knee joint Addon
#include "<ANYBODY_PATH_MODELUTILS>/MovingAxisKnee/AddOnKnee.any"
//-----
```



Iwaki, H. et al 2000



**[www.anybodytech.com](http://www.anybodytech.com)**

- Events, dates, publication list, ...

**[www.anyscript.org](http://www.anyscript.org)**

- Wiki, **Forum**, Repositories

**Events:**

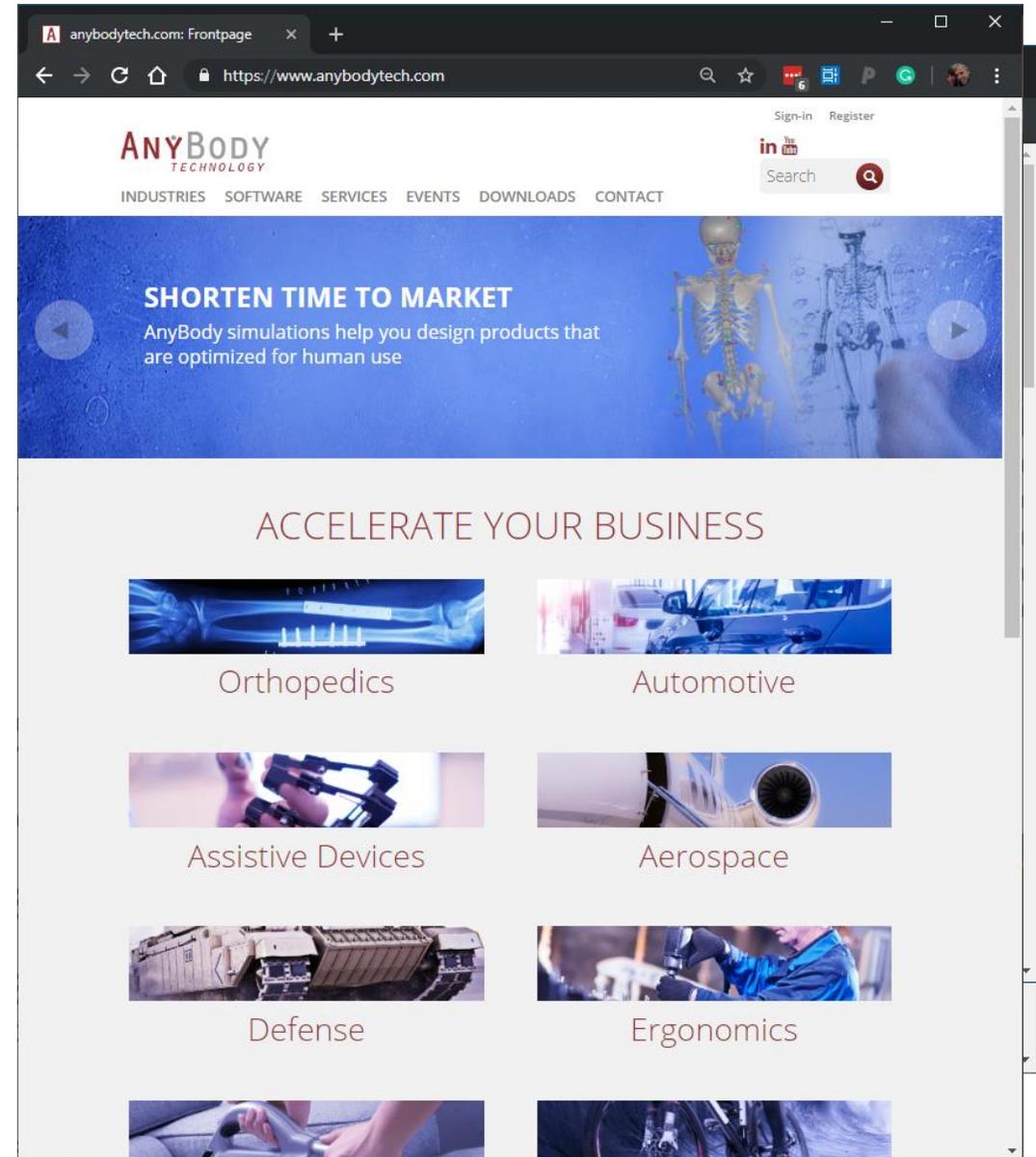
**Now:** ICRA 2019, Montreal, Canada

**23-24 May:** Seminar - From Mimics segmentation to MSM modeling

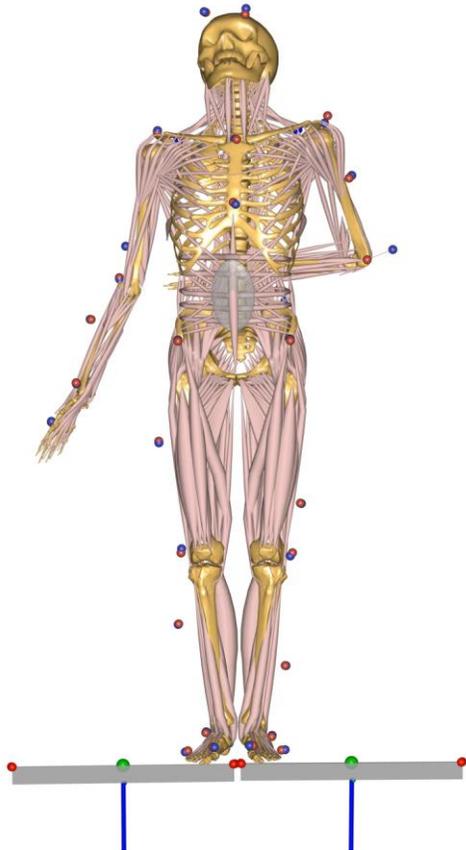
**28 Jul:** TGCS 2019 – ISB satellite conference  
Workshop on knee osteoarthritis and knee cartilage mechanic

**31 Jul- 4 Aug:** International Society of Biomechanics 2019 -  
Calgary, Canada.

 **Meet us?** Send email to [sales@anybodytech.com](mailto:sales@anybodytech.com)



# Time for questions:



AnyScript forum

https://forum.anyscript.org

**ANYSCRIPT FORUM** Sign Up Log In

all categories all tags **Categories** Latest Top

Category	Topics	Latest
<b>Main Forum</b> This is the category for discussion about the AnyBody Modeling System and problems with models	19 / month	Z Error when loading C3D model 1h ■ Main Forum
<b>Announcements</b> Big and small news AnyBody Modeling System, and Model Repository (AMMR)	2	Y Misalignment of robot joint and human joint 8h ■ Main Forum
<b>Blog comments</b> This category is for collecting discussions from blog posts on <a href="https://www.anyscript.org">AnyScript.org</a> . Do not create new topics in this category. They are created automatically when people comment on blog posts.	1 / month	E Changing the TrailFileName with AnyPy Tools 21h ■ Main Forum
		Request for c3d2any.exe and gaitapplication2.exe 9d ■ Main Forum
		Node Orientation 9d ■ Main Forum kinematics