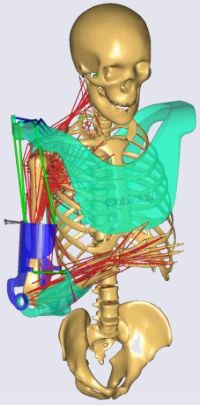
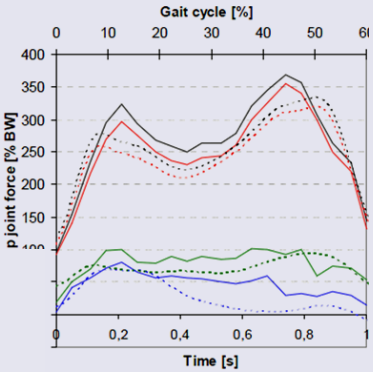
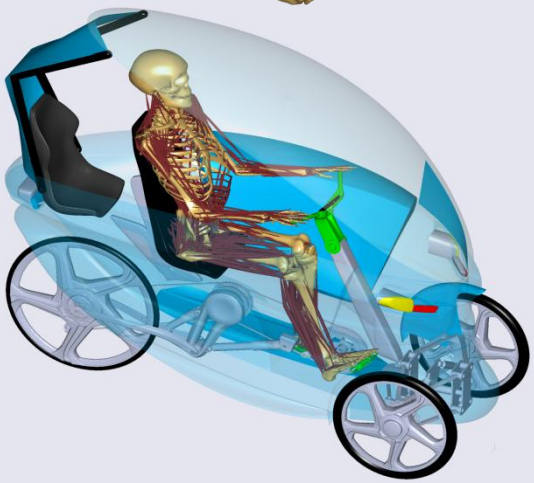
SolidWorks2AnyBody: A new powerful SolidWorks add-in application

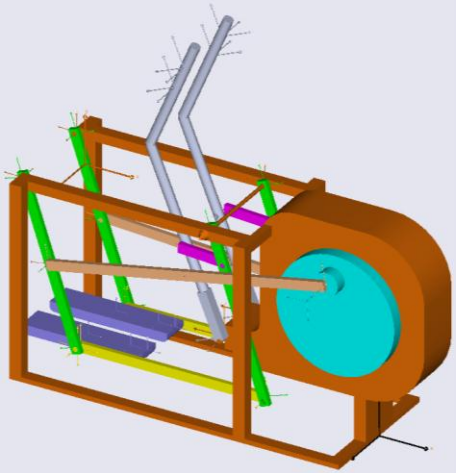
Moonki Jung
mj@anybodytech.com

The web cast will start in a few minutes….





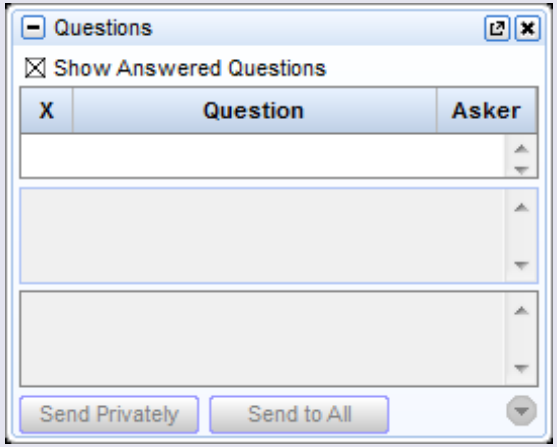




ANYBODY TECHNOLOGY

Agenda & Presenters

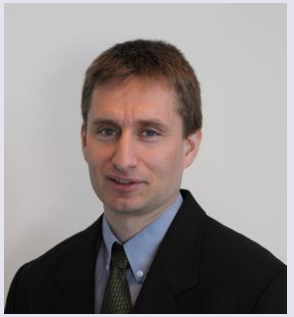
- AnyBody Modeling System (AMS)
- AnyBody Model Repository
- Solidworks2AnyBody Translator
  - Layout
  - Function
  - Applications
- Q & A (submit questions anytime)



Moonki Jung
(Presenter)

Amir Al-Munajjed
(*Host/Panelist*)

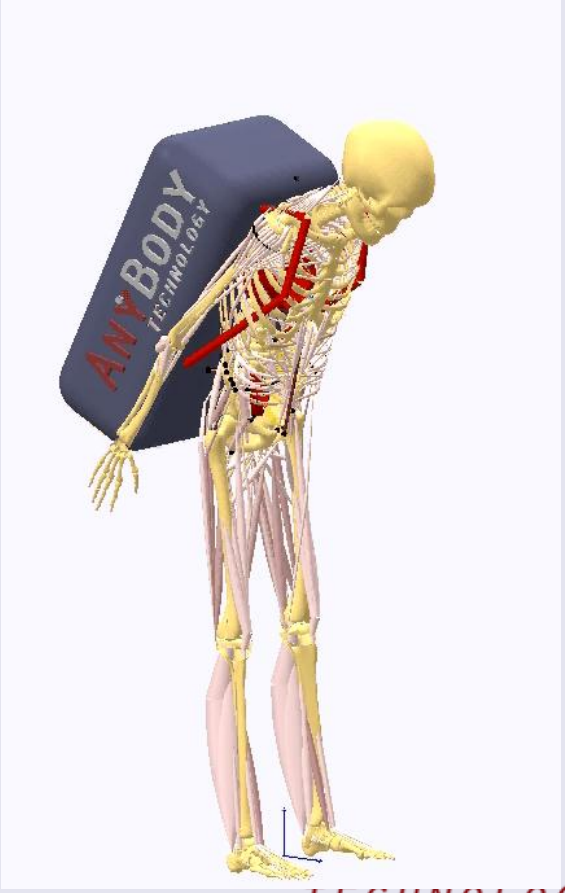
Michael Damsgaard
(Panelist)



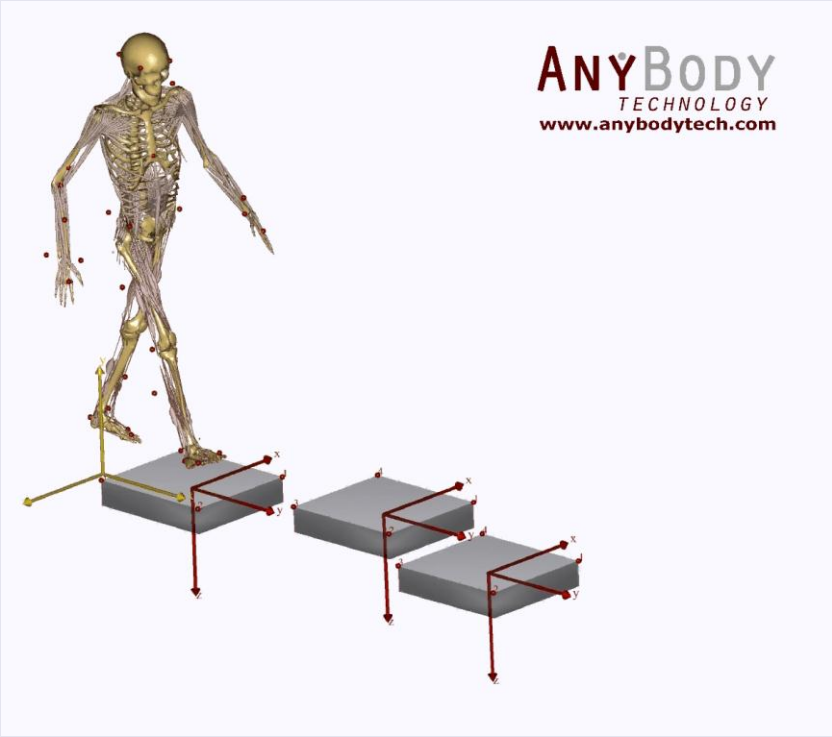
ANYBODY TECHNOLOGY

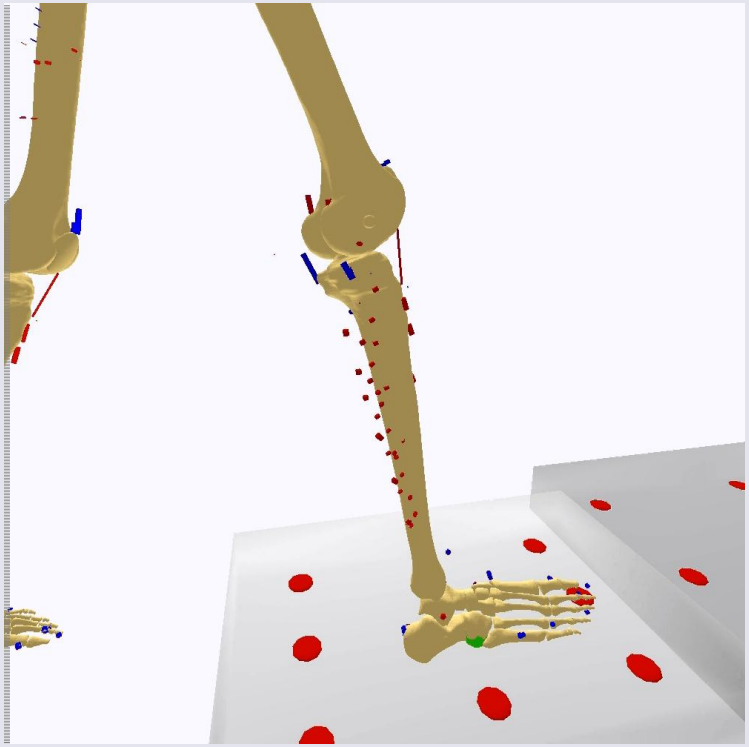
AnyBody Modeling System

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



AnyBody Modeling System





Motion & ext Forces as Input:

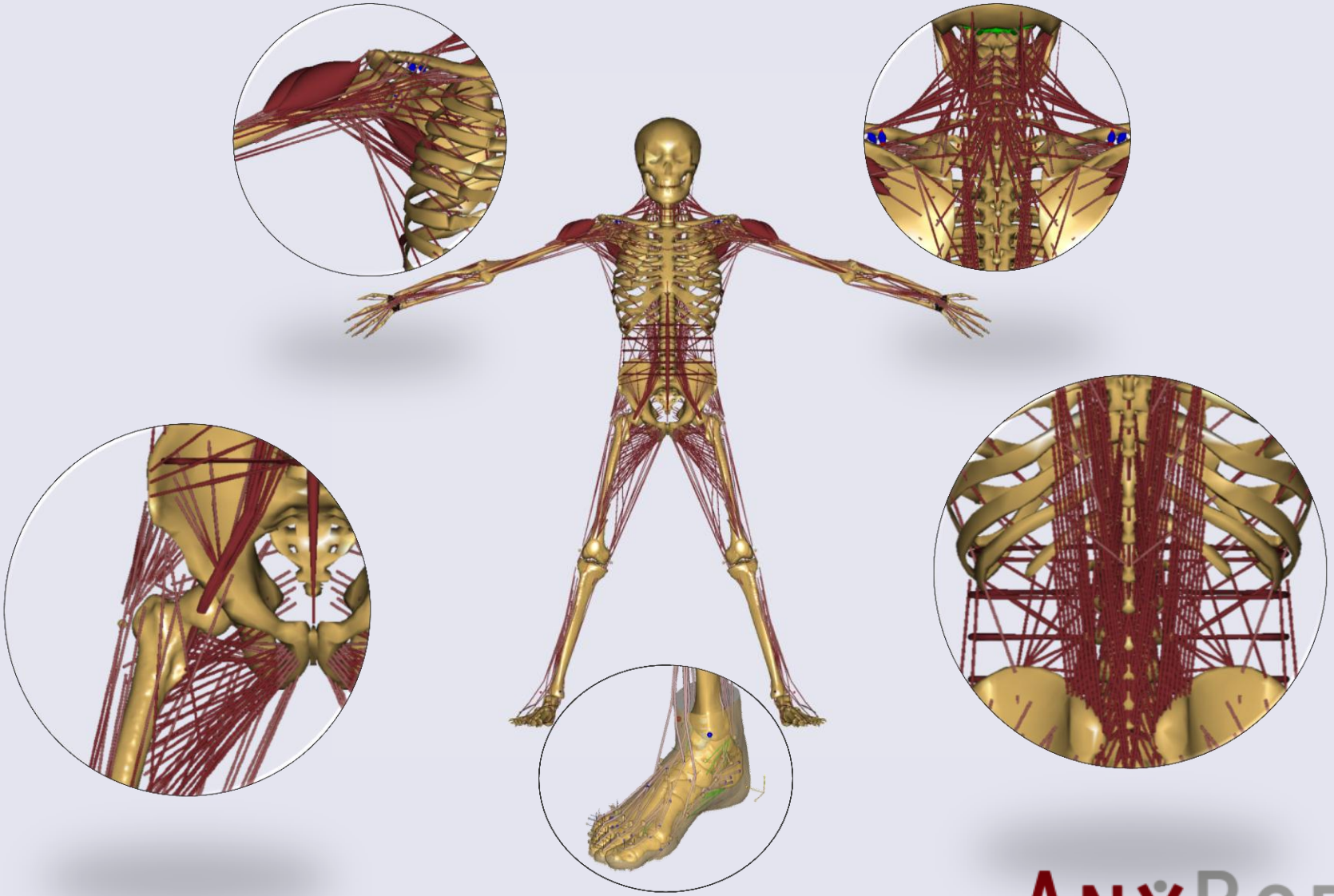
- Motion Capture (Vicon, Qualisys, ...)
- Joint Angle Input

Forces as Output:

- Muscle Forces (activations)
- Joint Reaction Forces

ANYBODY TECHNOLOGY

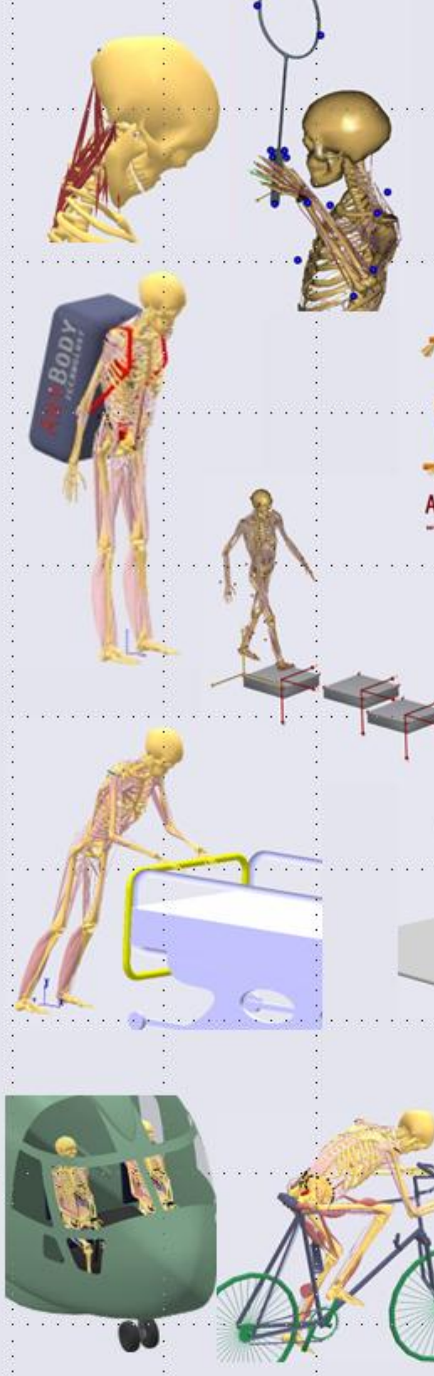
The AnyBody Managed Model Repository™

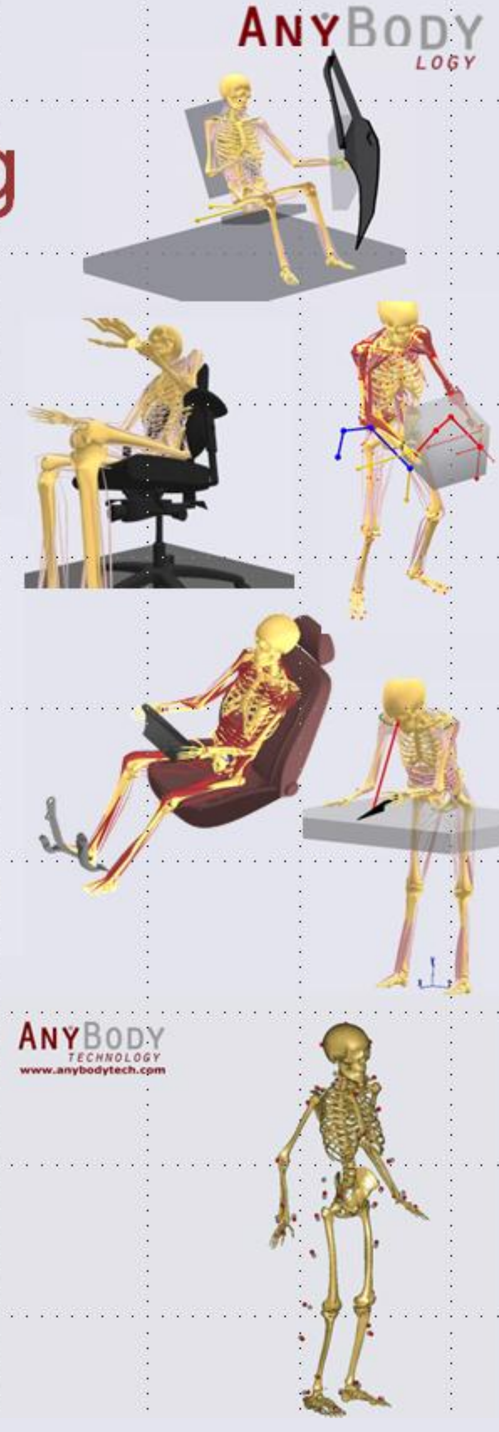


ANYBODY TECHNOLOGY

Activities of daily living

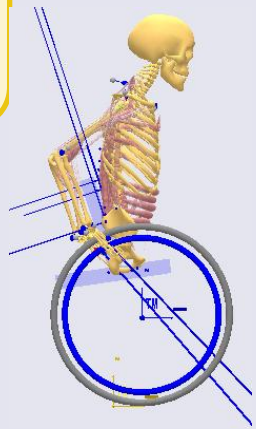
Activities needed for realistic in-vivo results



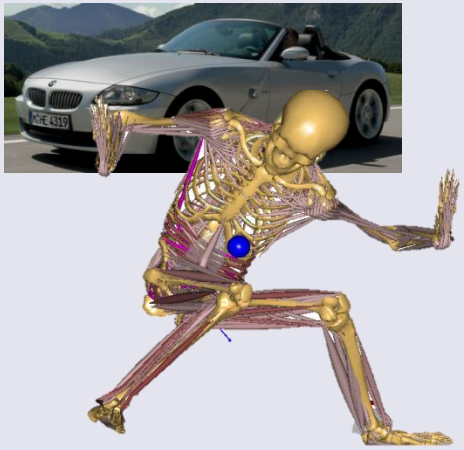


Gait Application
AnyGait

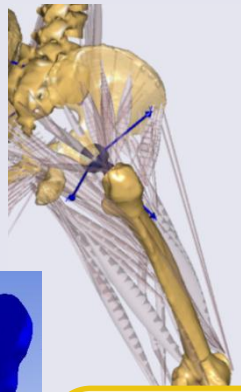
Product Design
Optimization

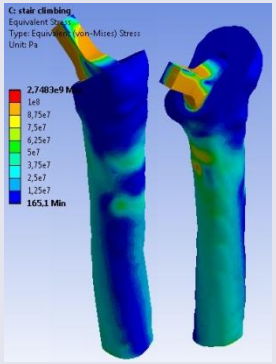


Ergonomic
Analysis and
Documentation

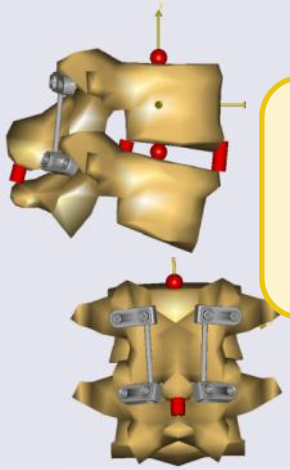


AnyBody
Modeling System





Physiological Load
Cases for Finite
Element Analysis



Surgical Planning, -
Evaluation & -Failure
Analysis

AnyBody
TECHNOLOGY

SolidWorks2AnyBody: Motivation

For design of products with man-machine interface, the optimization of design variables is essential for their function.

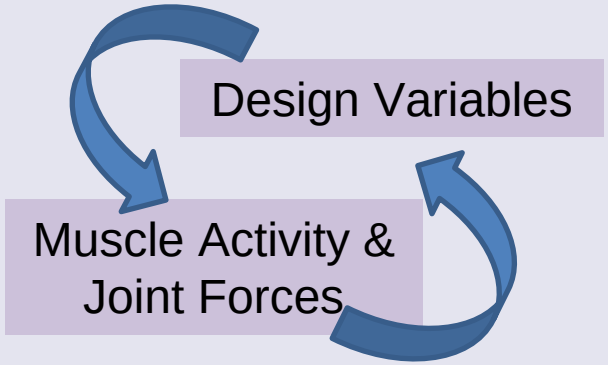
- Physical experiments in Labs require a lot of time and effort

- Manufacturing of prototypes is very cost intensive

- Computer Aided Design and Simulation is reducing costs and time

Objective:

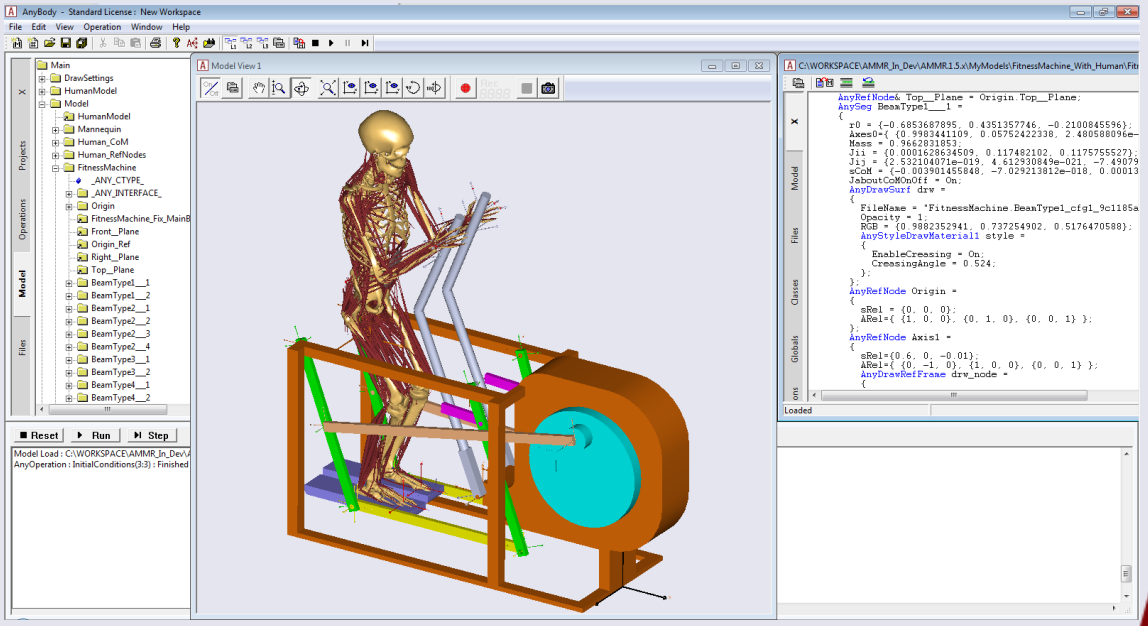
- Create short loop between CAD models and musculoskeletal analysis



ANYBODY TECHNOLOGY

SolidWorks2AnyBody: A new powerful SolidWorks add-in to translate your CAD model

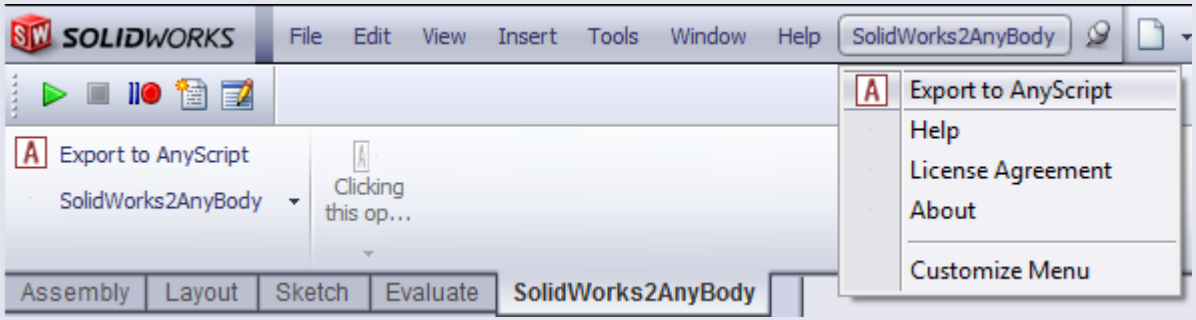
- Translate your CAD model into AnyBody automatically
  1. Geometry (STL file)
  2. Mass properties
  3. Initial position and rotation
  4. Mate types
  5. Reference geometries

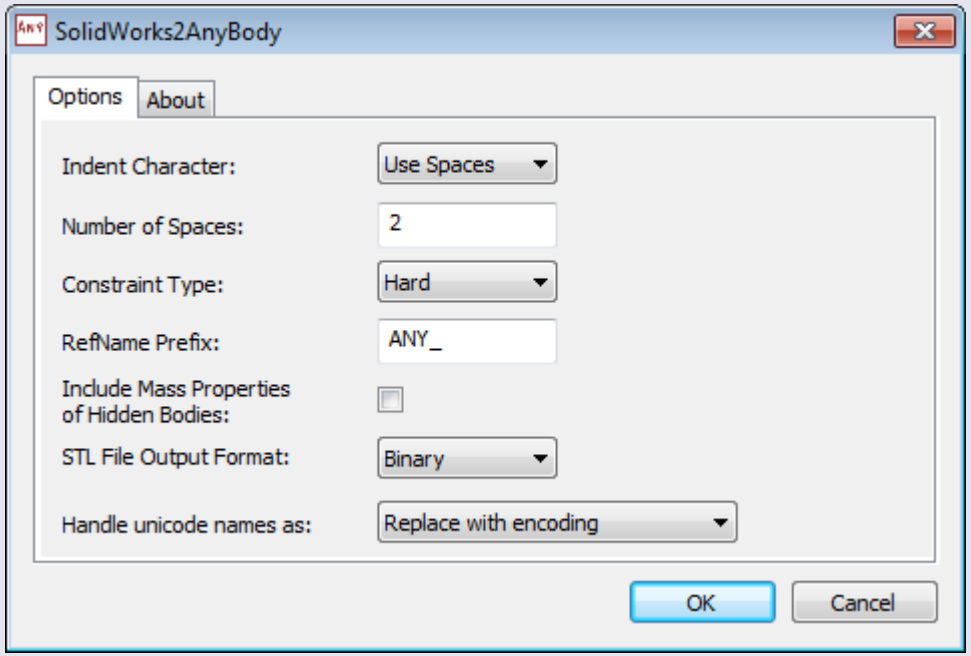


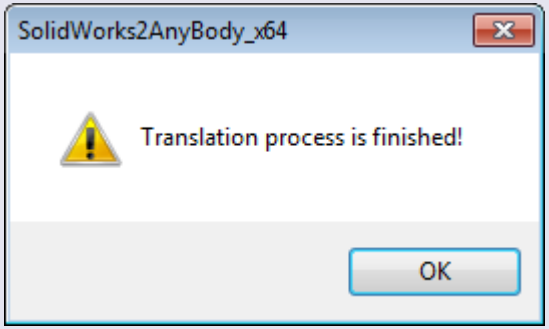
ANYBODY TECHNOLOGY

User interface for SolidWorks2AnyBody

- An add-in application which can be used in SolidWorks



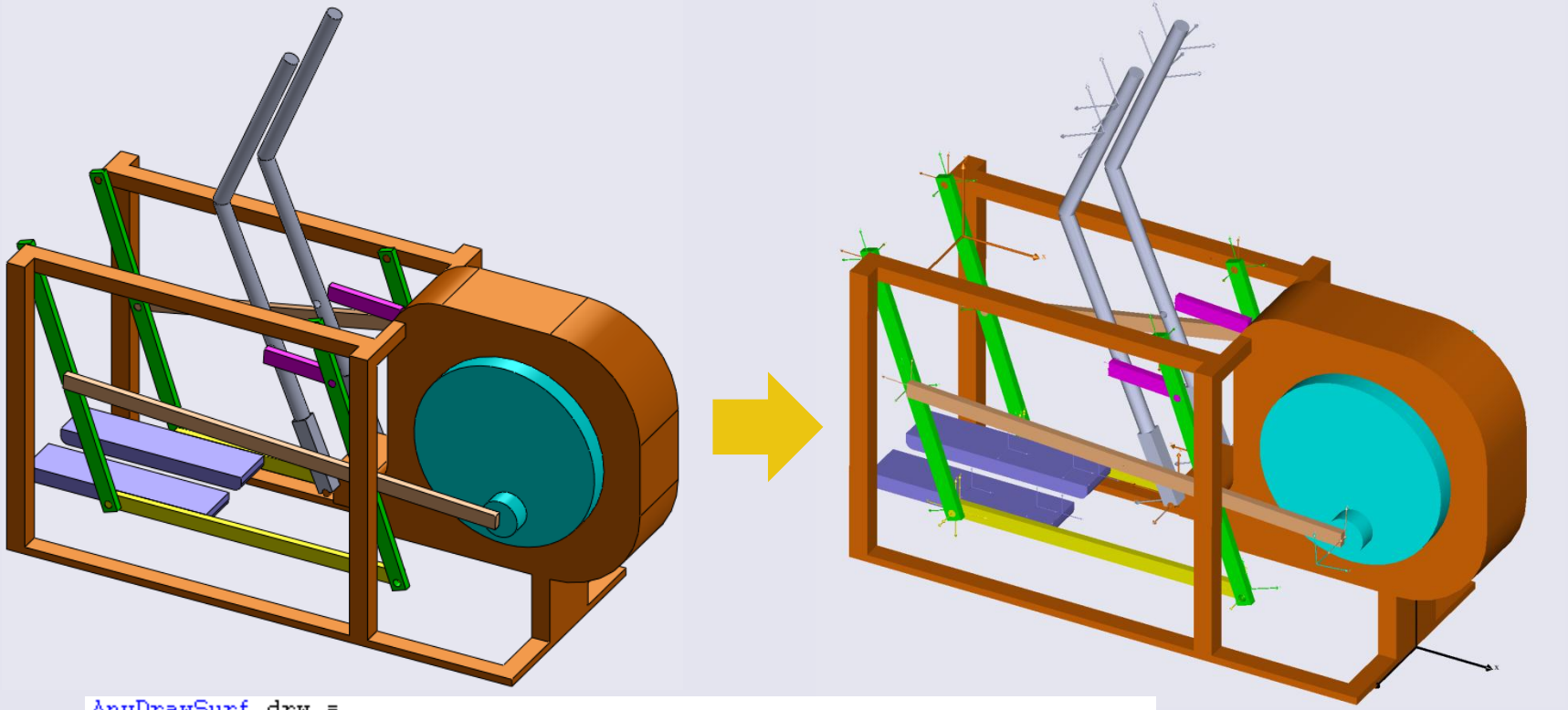




ANYBODY TECHNOLOGY

What will be translated: 1. Geometry (STL)

- Individual STL files for each part can be generated

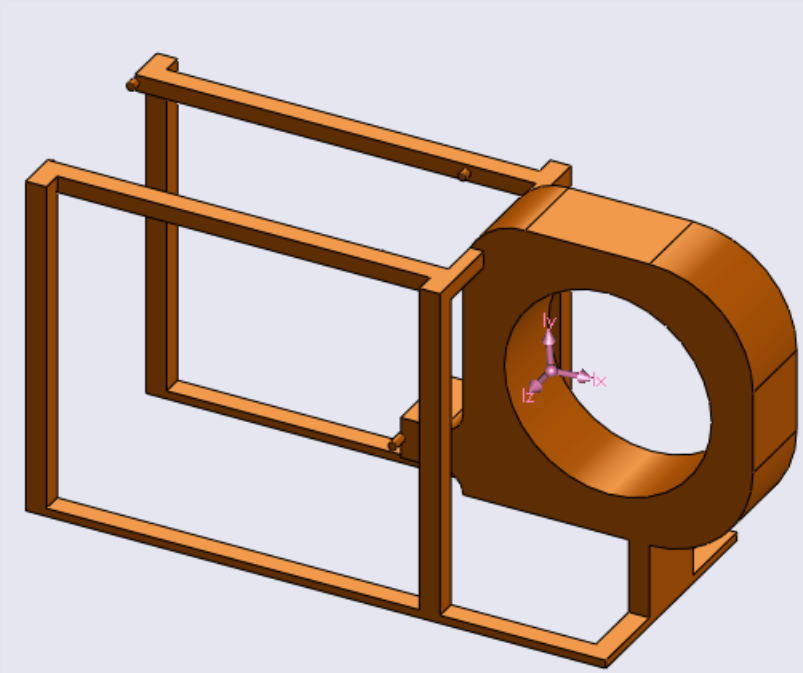


```
AnyDrawSurf drw =
{
  FileName = "FitnessMachine.MainCylinder_cfg0_9c1185a5c5e9fc546128.stl";
  Opacity = 1;
  RGB = {0, 1, 1};
  AnyStyleDrawMaterial1 style =
  {
    EnableCreasing = On;
    CreasingAngle = 0.524;
  };
};
```

ANYBODY TECHNOLOGY

What will be translated: 2. Mass Properties

- Mass, center of mass and moments of inertia values



```
Mass properties of MainBase ( Part Configuration - Default )

Output  coordinate System: -- default --

Density = 1000.00000000 kilograms per cubic meter

Mass = 73.11799280 kilograms

Volume = 0.07311799 cubic meters

Surface area = 2.99065993 square meters

Center of mass: ( meters )
     X = -0.18990690
     Y = -0.04988091
     Z = 0.00001942

Principal axes of inertia and principal moments of inertia: ( kilograms * square meters )
Taken at the center of mass.
     Ix = (0.99680585, 0.07986301, -0.00005817)      Px = 6.17565192
     Iy = (-0.07986302, 0.99680583, -0.00017447)     Py = 13.40049353
     Iz = (0.00004406, 0.00017856, 0.99999998)       Pz = 17.11071686

Moments of inertia: ( kilograms * square meters )
Taken at the center of mass and aligned with the output coordinate system.
     Lxx = 6.22173273      Lxy = 0.57515458      Lxz = -0.00058241
     Lyx = 0.57515458      Lyy = 13.35441288     Lyz = -0.00069607
     Lzx = -0.00058241     Lzy = -0.00069607     Lzz = 17.11071671

Moments of inertia: ( kilograms * square meters )
Taken at the output coordinate system.
     Ixx = 6.40365800      Ixy = 1.26778148      Ixz = -0.00085212
     Iyx = 1.26778148      Iyy = 15.99138620     Iyz = -0.00076691
     Izx = -0.00085212     Izy = -0.00076691     Izz = 19.92961525
```

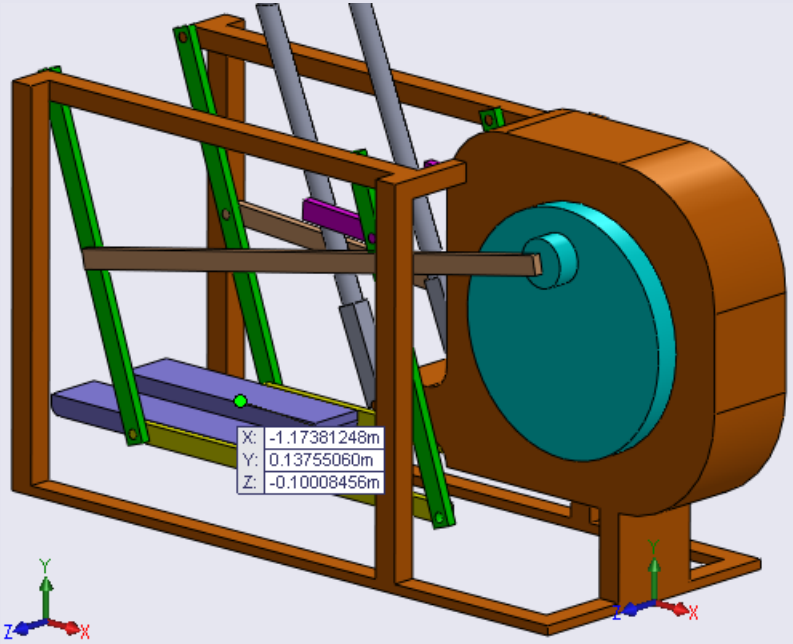
C:\WORKSPACE\[CAD]\[Tutorial]\FitnessTrainer_New\AnyScript3\FitnessMachine.any - Loaded

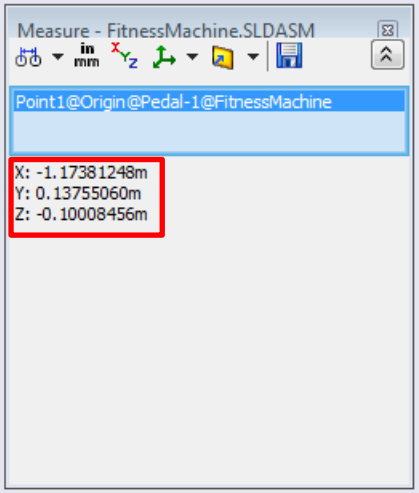
```
AnySeg MainBase___1 =
{
  r0 = {-0.1, 0.55, -8.455958313e-005};
  Axes0={ {1, 0, 0}, {0, 1, 0}, {0, 0, 1} };
  Mass = 73.1179928;
  Jii = {6.221732725, 13.35441288, 17.11071671};
  Jij = {0.5751545834, -0.0006960674174, -0.0005824144636};
  sCoM = {-0.189906896, -0.04988090848, 1.942340762e-005};
  JaboutCoMOnOff = On;
```

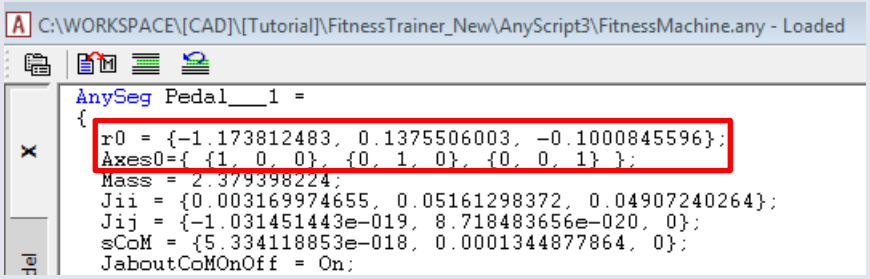
ANYBODY TECHNOLOGY

What will be translated: 3. Initial Position & Rotation

- Initial position and rotation values



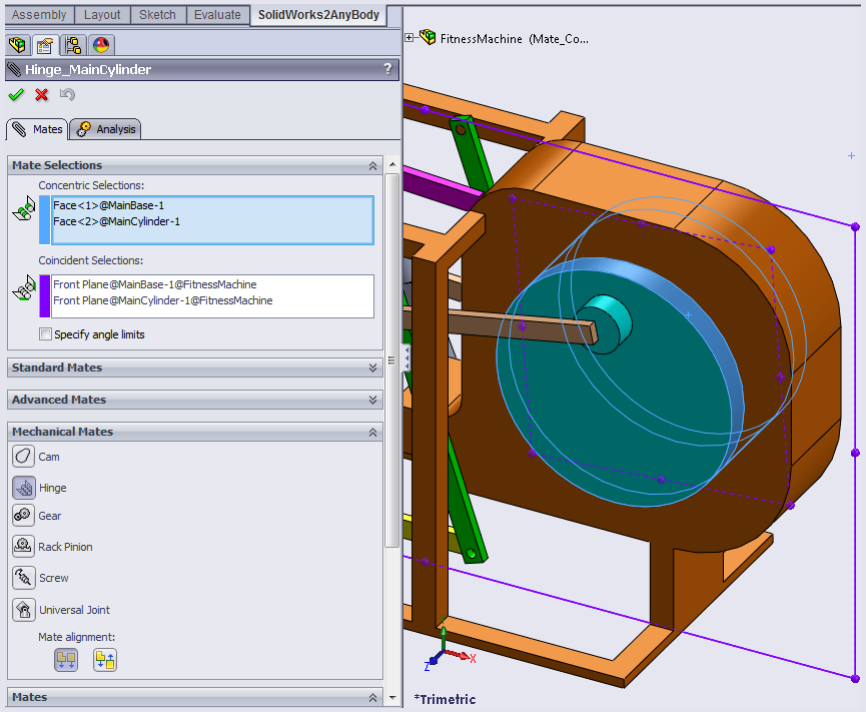


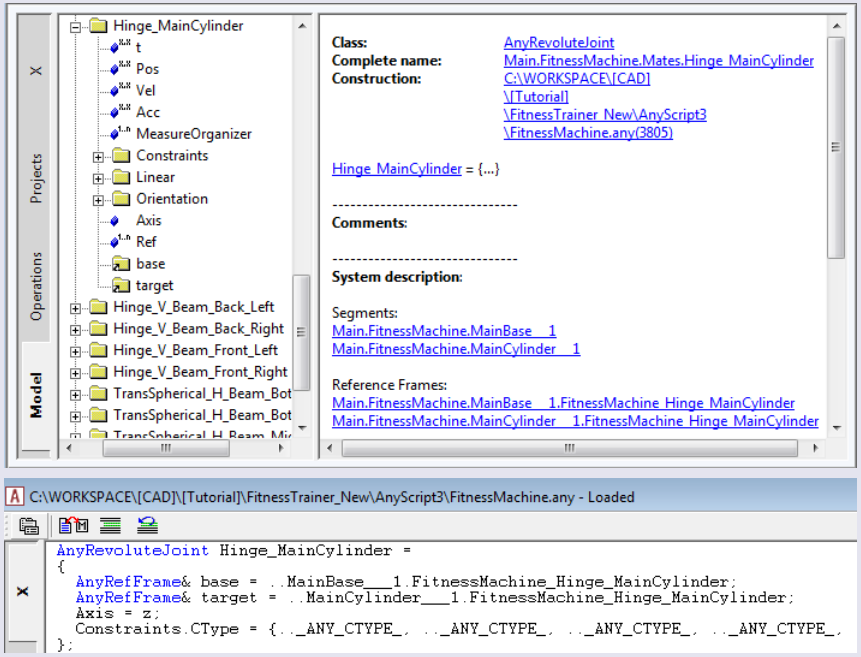


ANYBODY TECHNOLOGY

What will be translated: 4. Mates

- Mates will be transformed to AnyBody joint or constraint objects

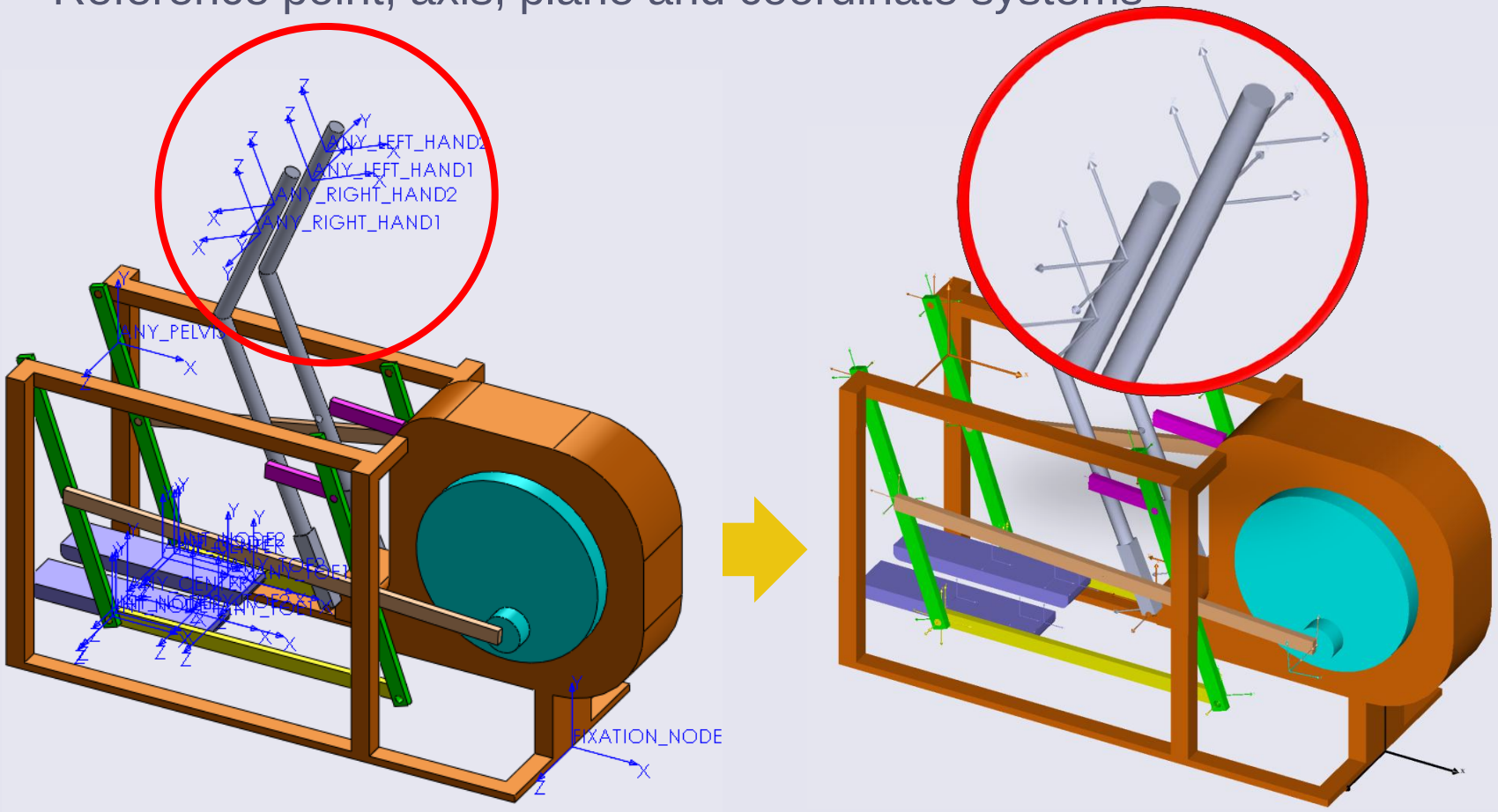




ANYBODY TECHNOLOGY

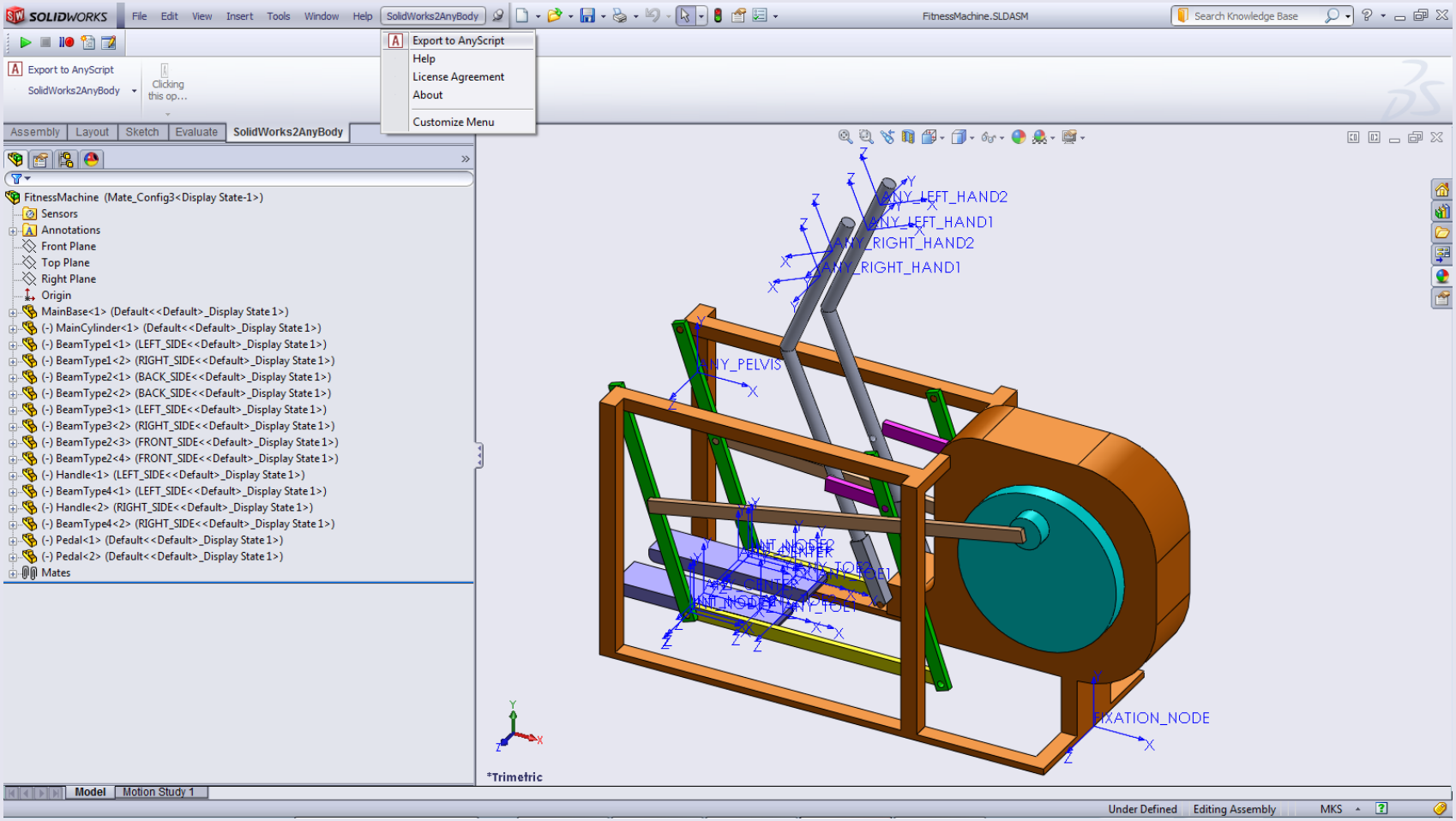
What will be translated: 5. Reference Geometry

- Reference point, axis, plane and coordinate systems



ANYBODY TECHNOLOGY

SolidWorks2AnyBody Demo Process



ANYBODY TECHNOLOGY

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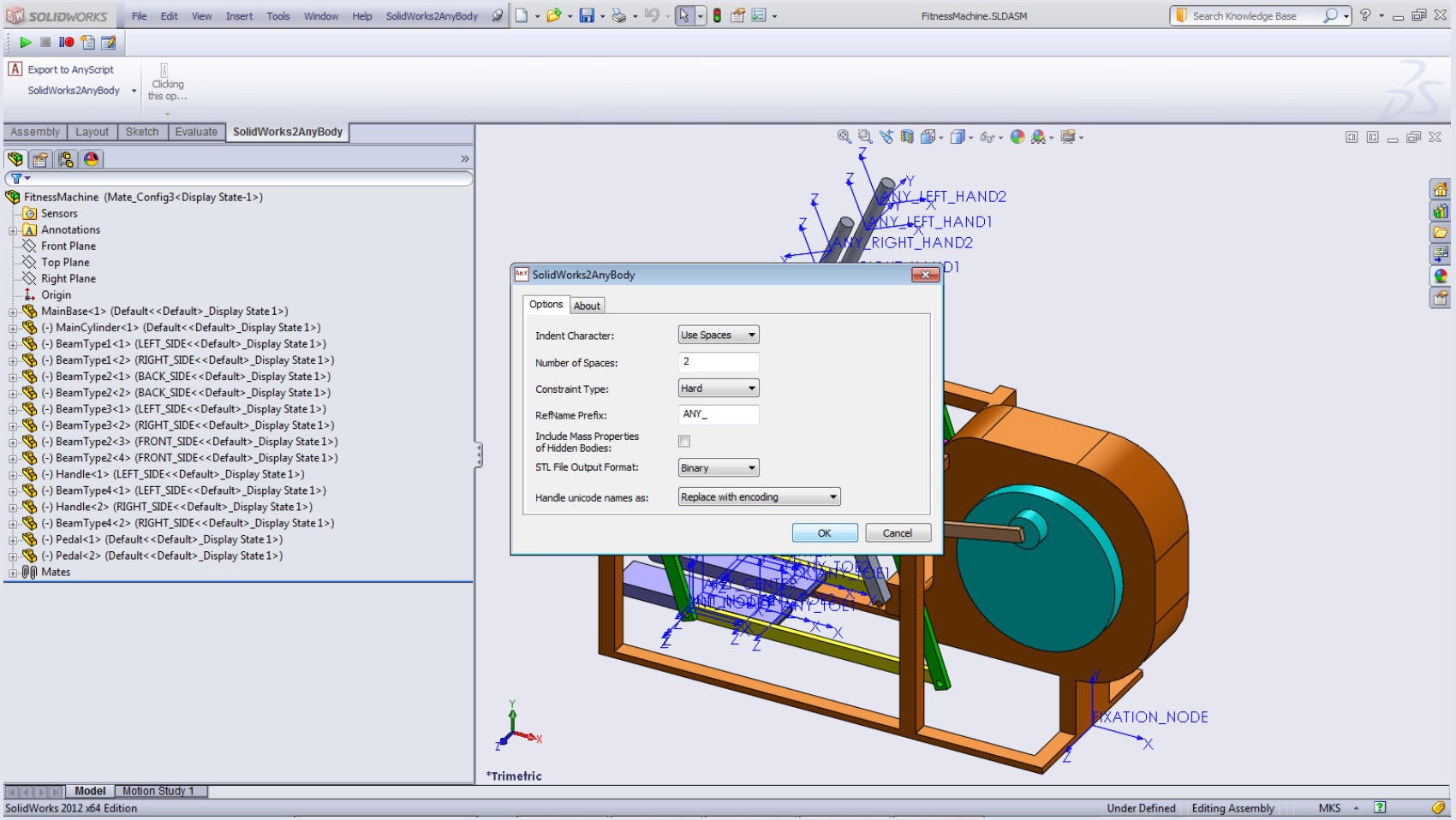

ANYBODY TECHNOLOGY

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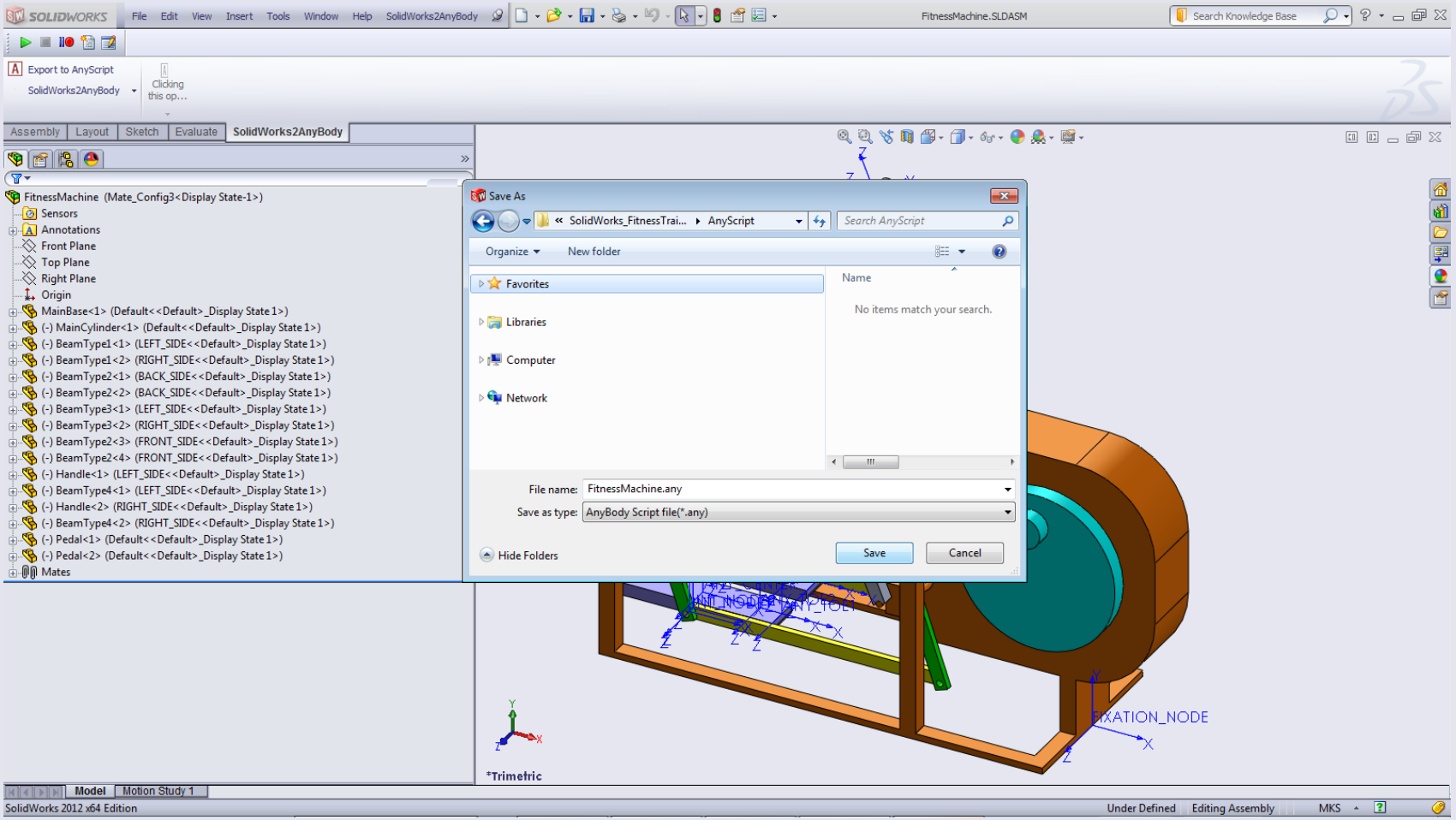

ANYBODY TECHNOLOGY

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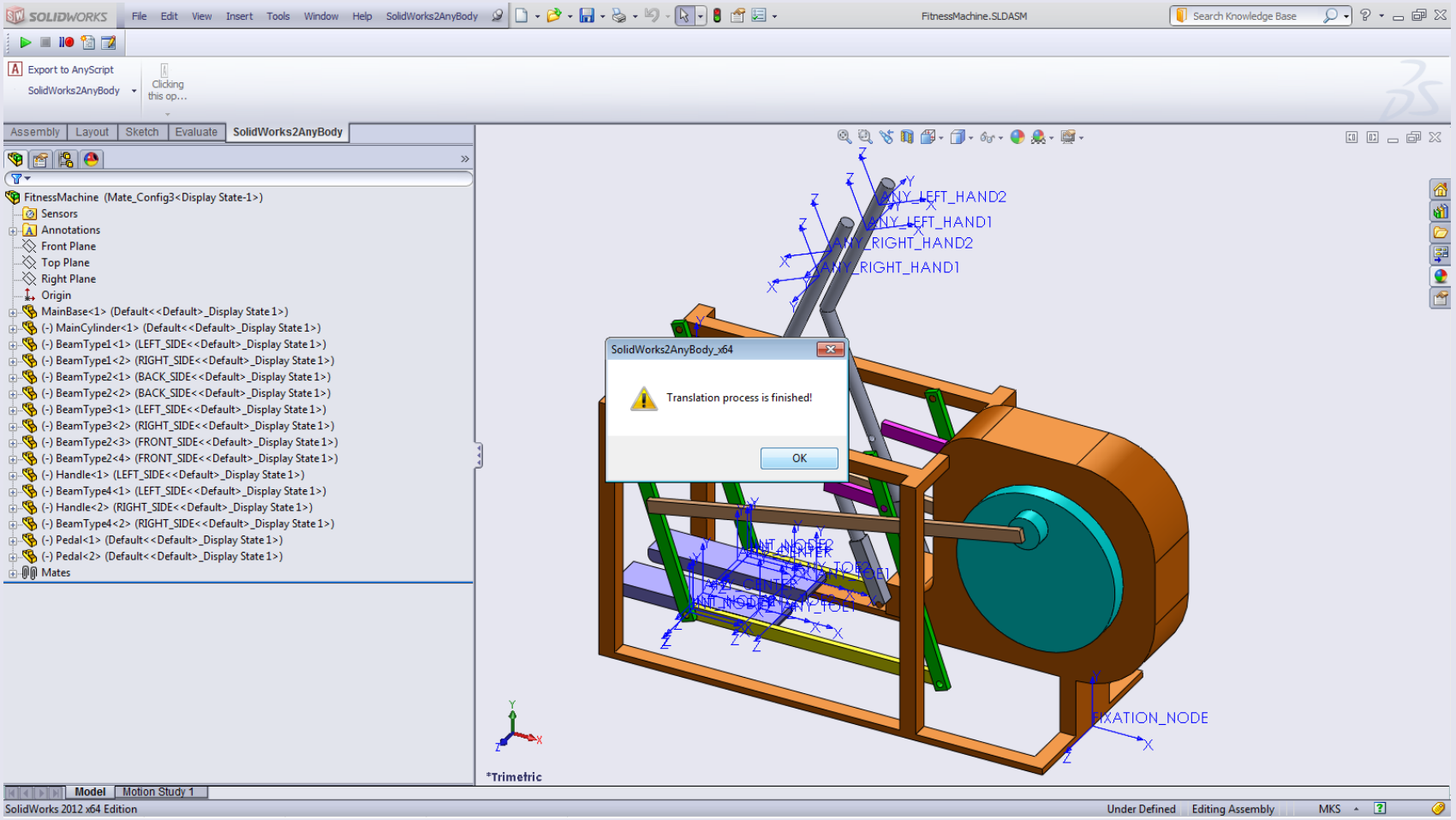
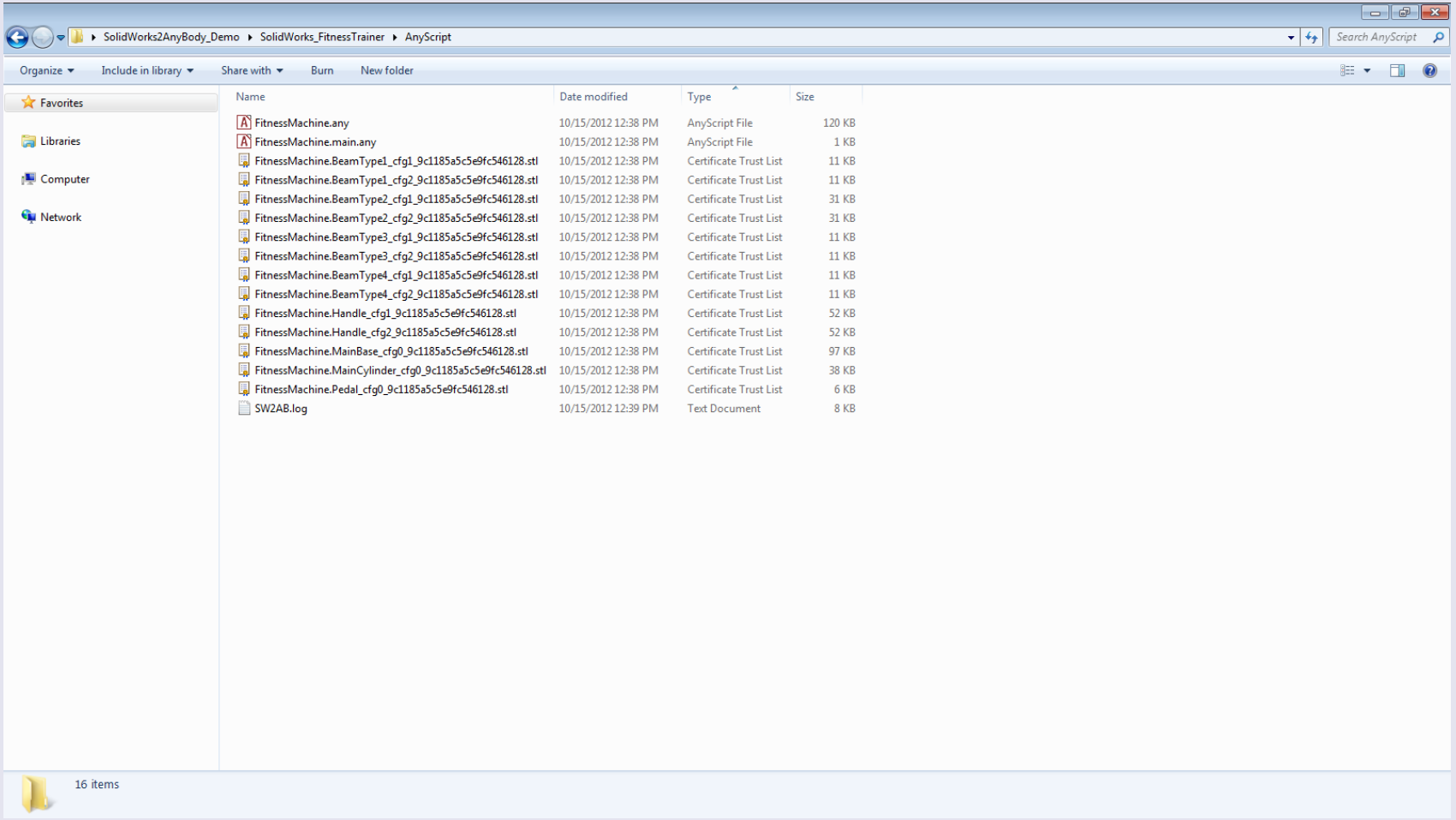


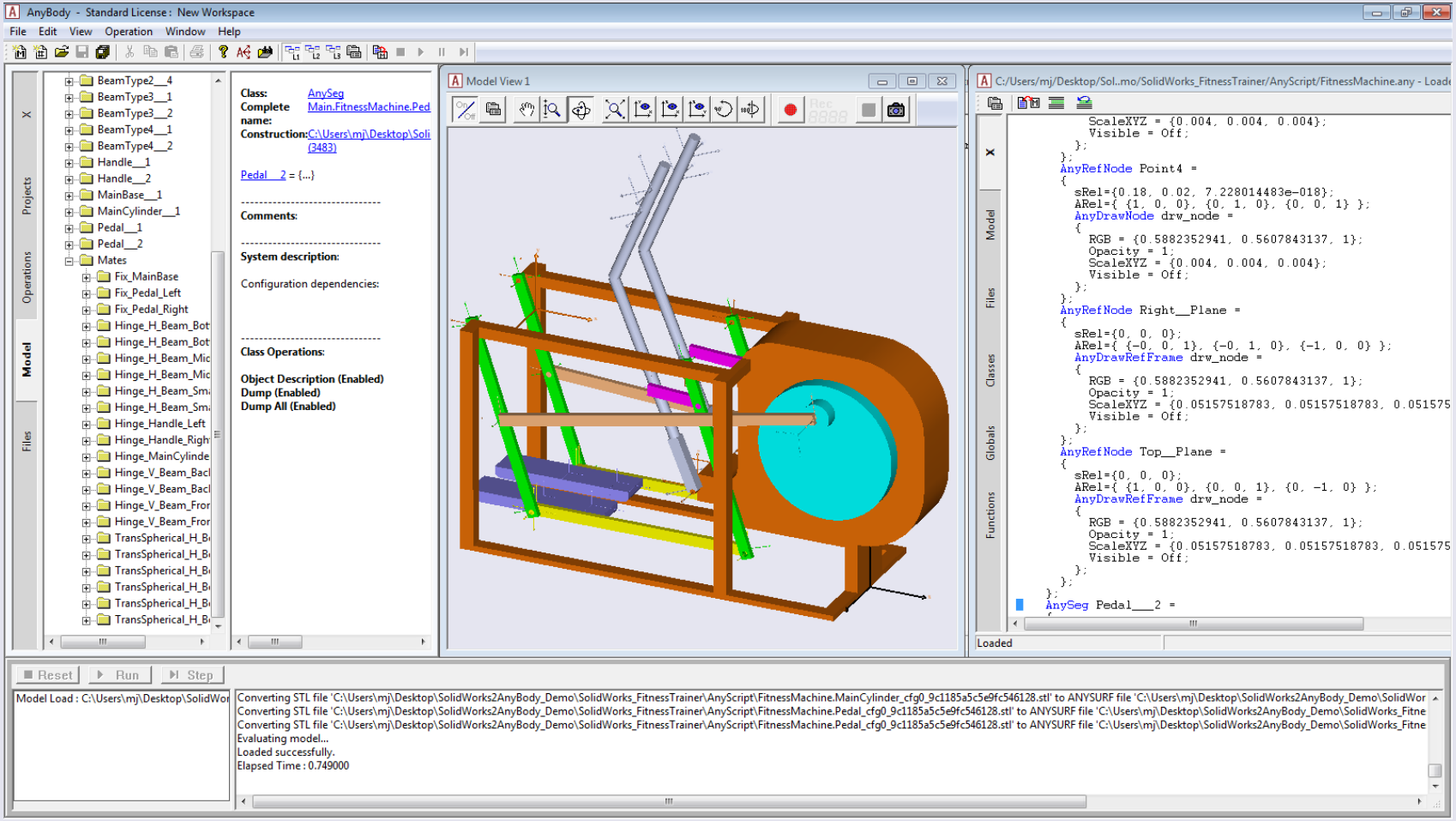
ANYBODY TECHNOLOGY

SolidWorks2AnyBody Demo Process



ANYBODY TECHNOLOGY

SolidWorks2AnyBody Demo Process



ANYBODY TECHNOLOGY

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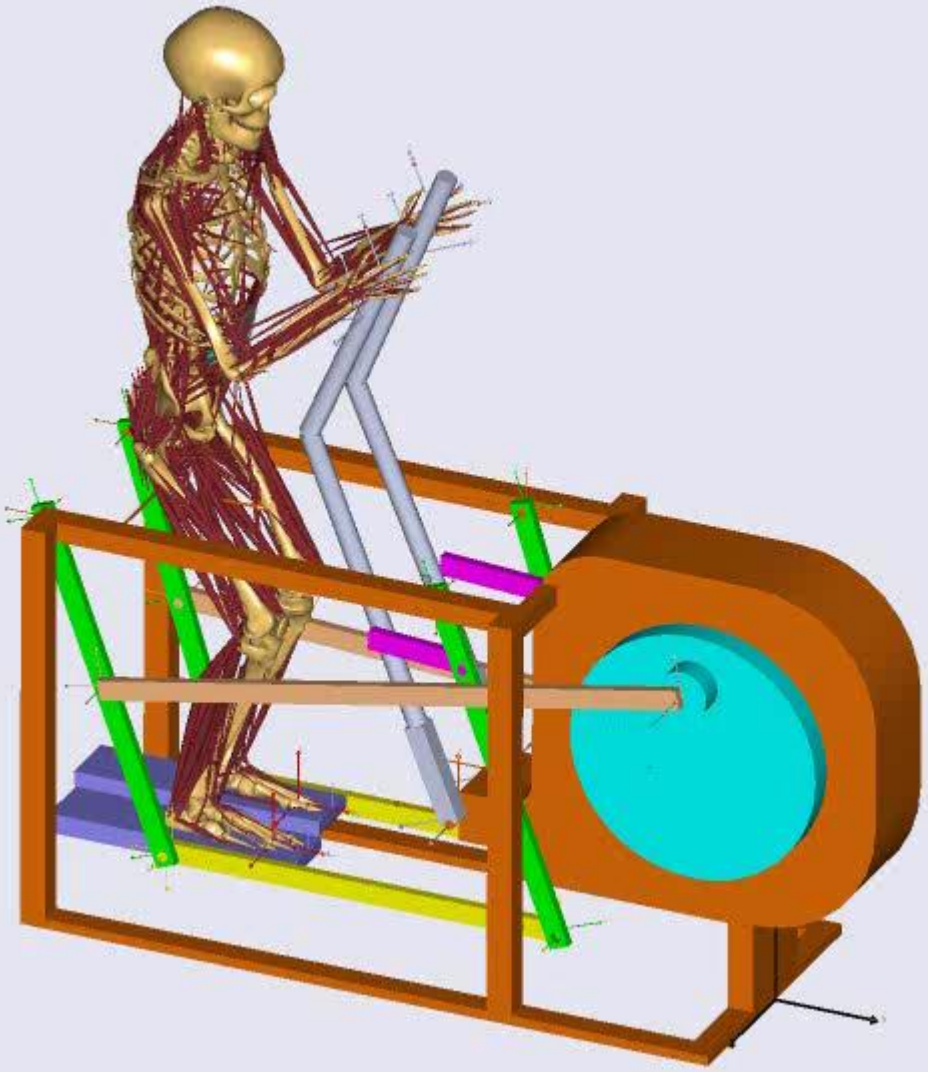
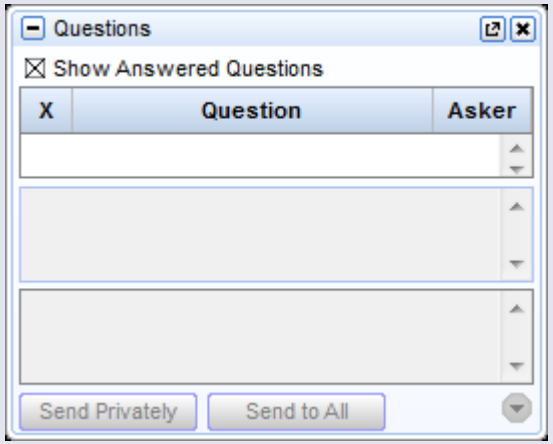
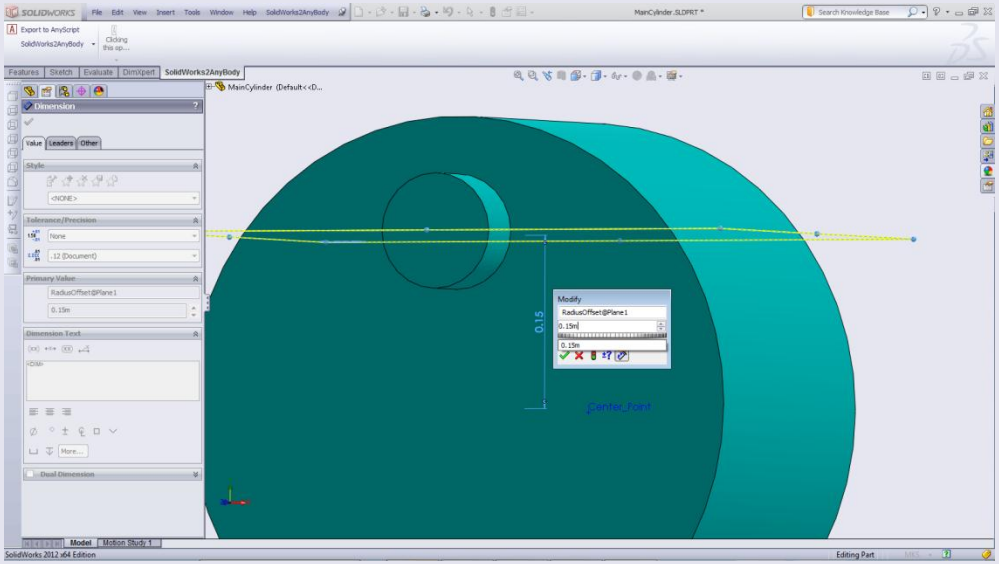
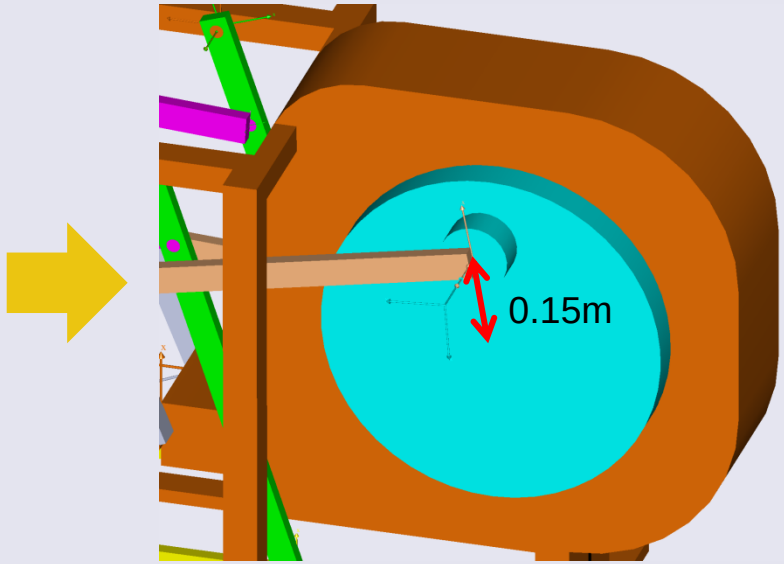


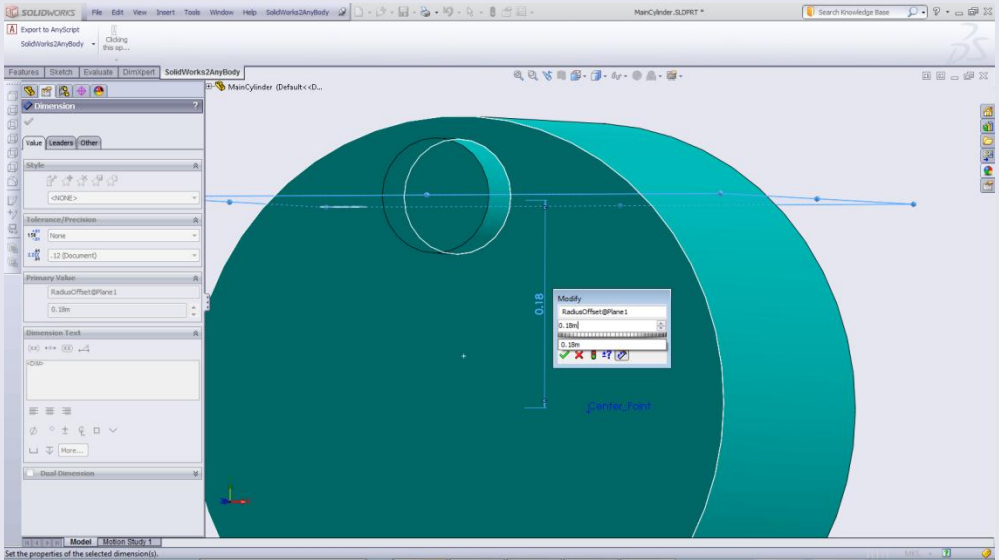


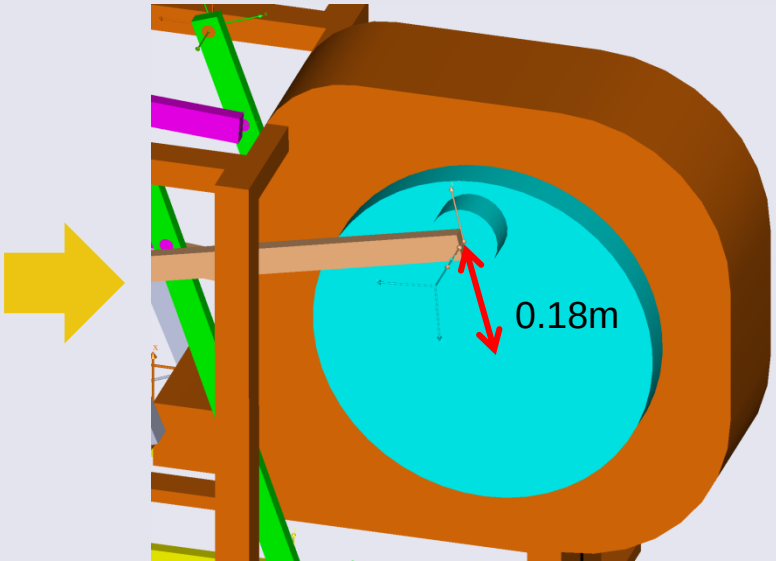
ANYBODY TECHNOLOGY

Effect of design alterations: change of radius

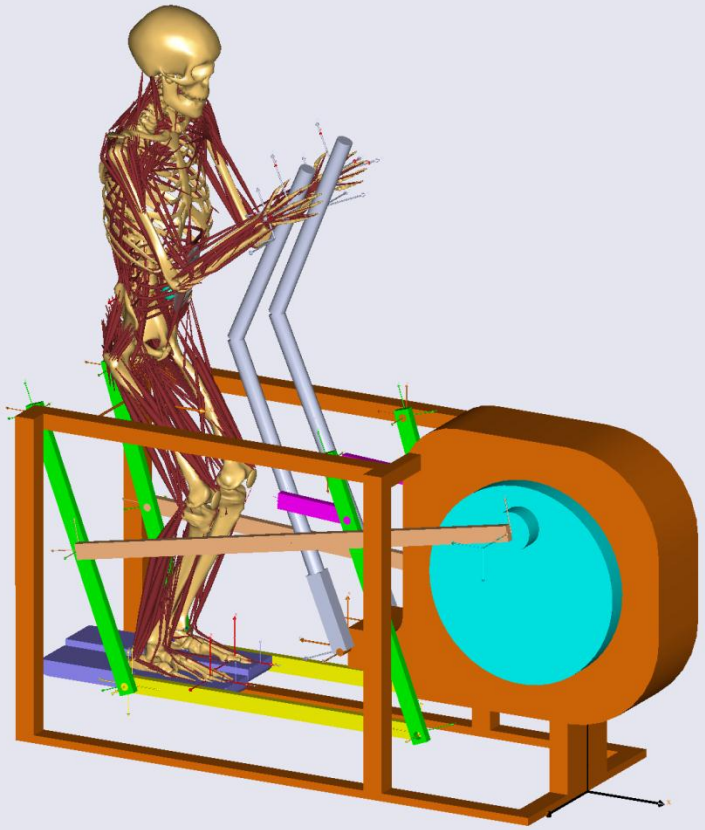


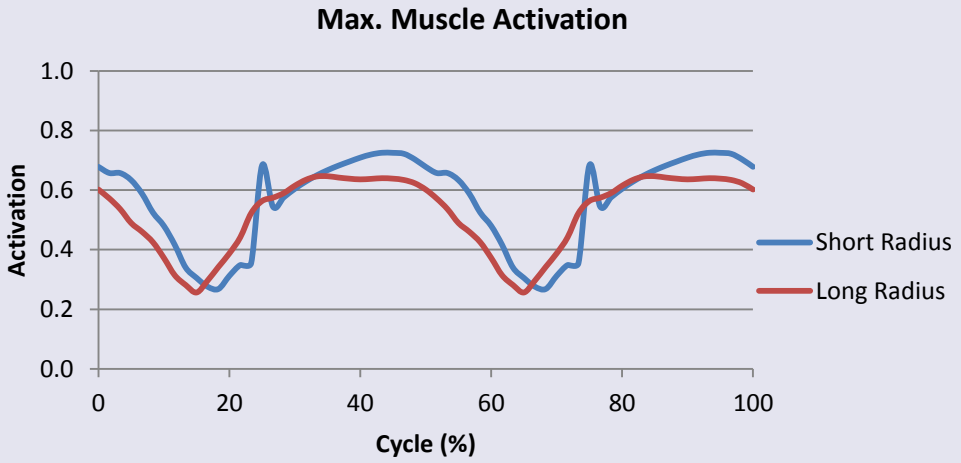


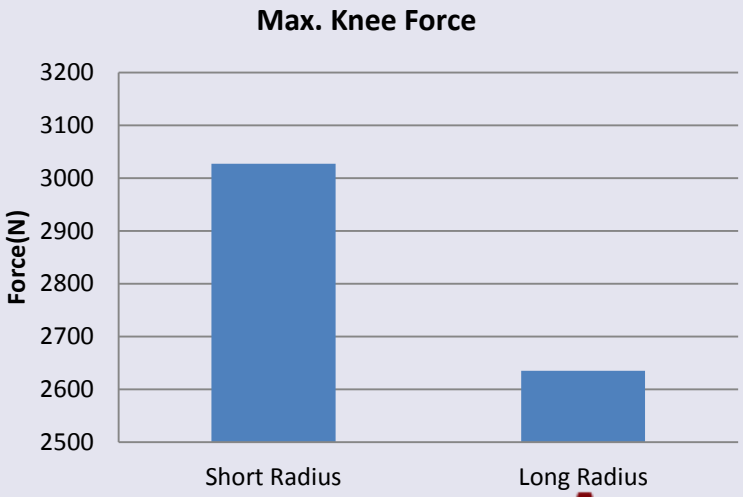




Effect of design alterations: change of radius



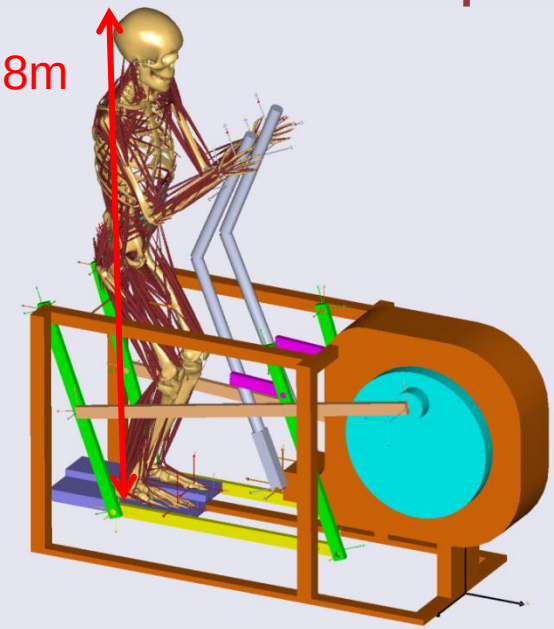


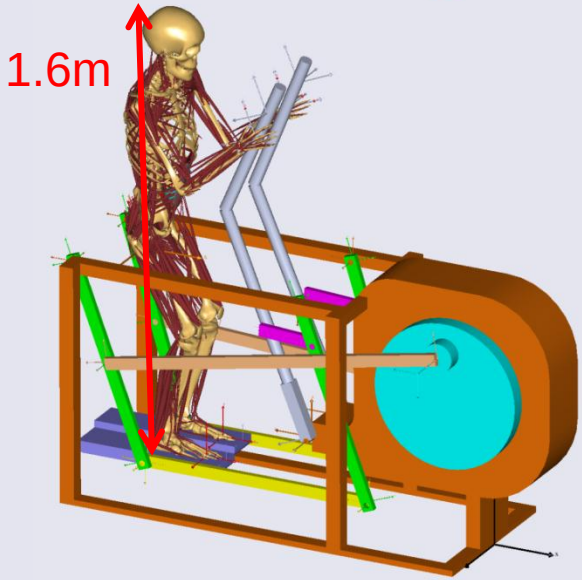


ANYBODY TECHNOLOGY

Adaptation to different Anthropometry

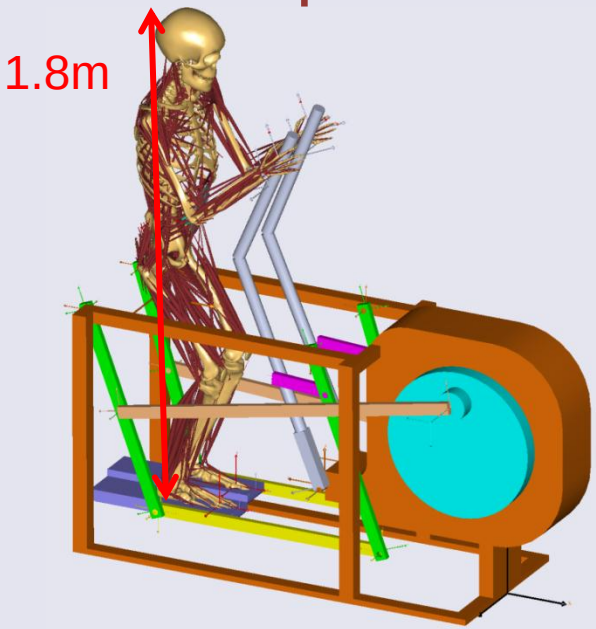
See previous Webcast on Anthro Scaling Rasmussen(19. March, 2009)

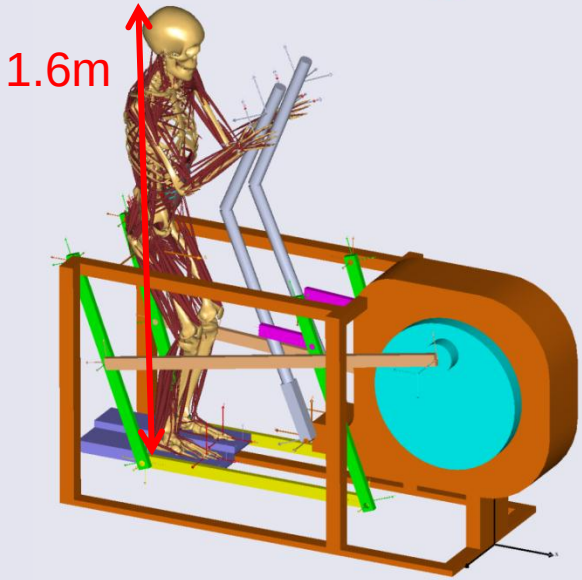


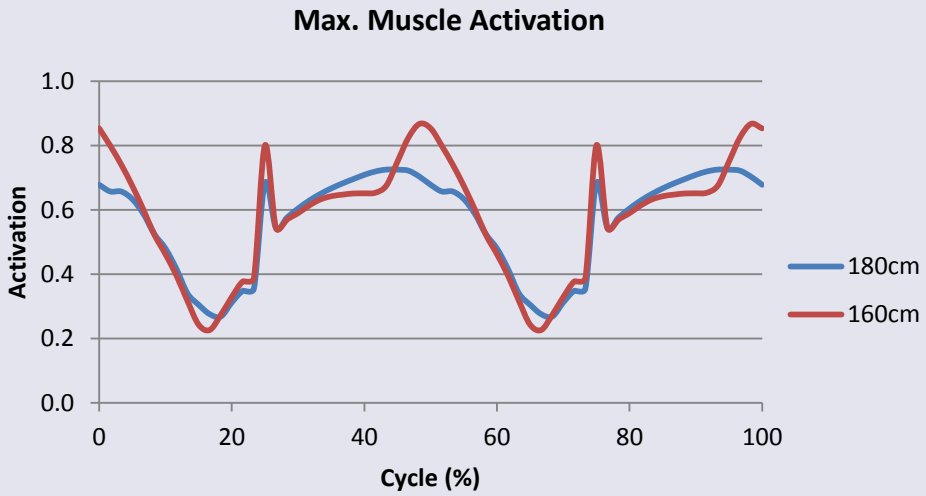


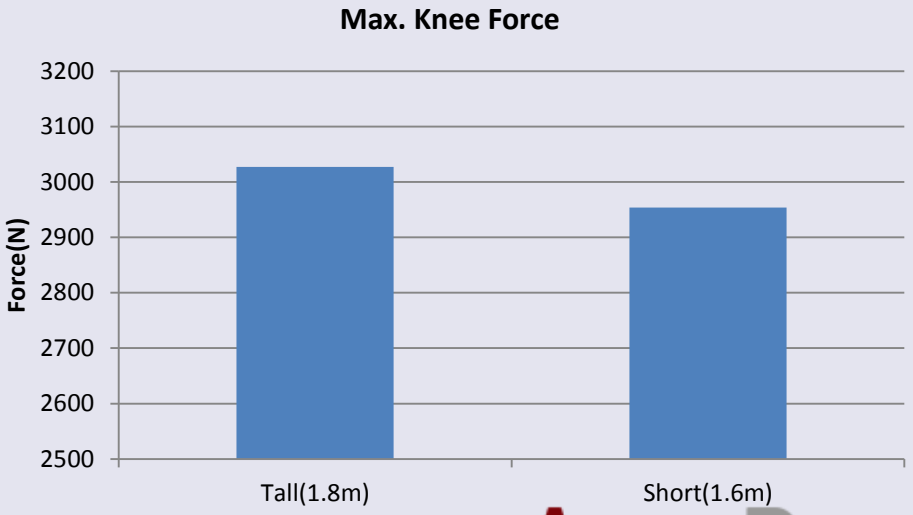
ANYBODY TECHNOLOGY

Adaptation to different Anthropometry









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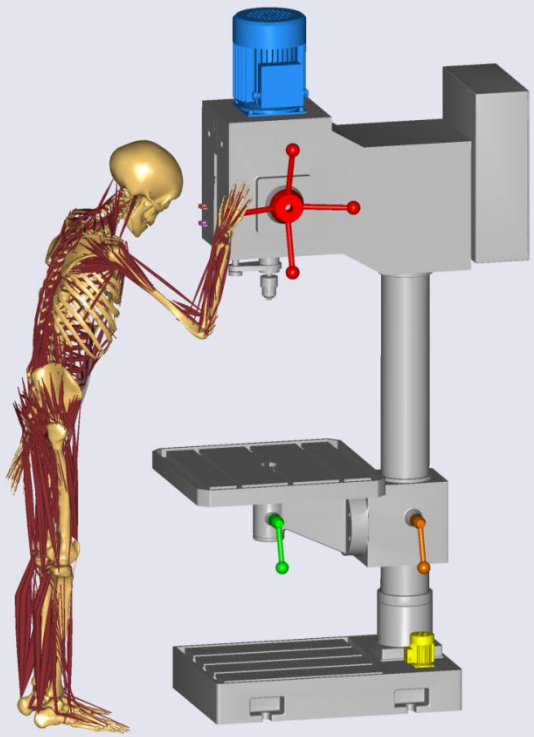
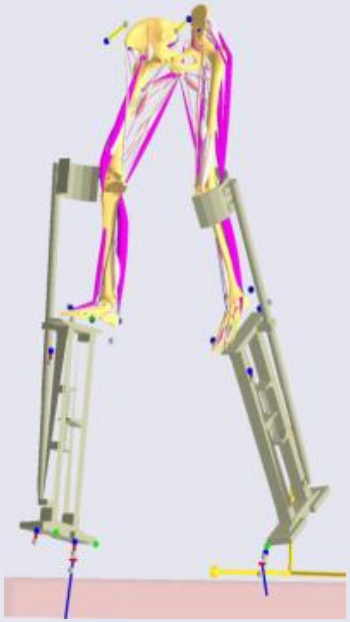
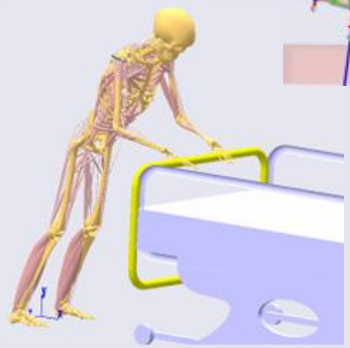
Field of Applications: Work Ergonomics





Wu et al 2008



Selected Examples:

- Optimal design of drill machine to reduce loads in spine or shoulder
- Optimal design of hospital beds to ensure easy handling
- Analyzing work environment on stilts

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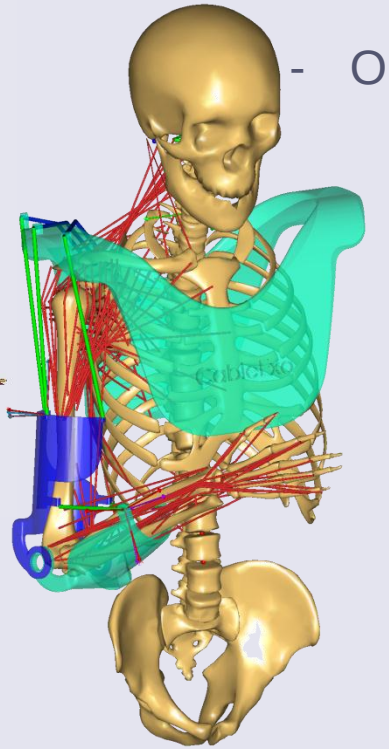
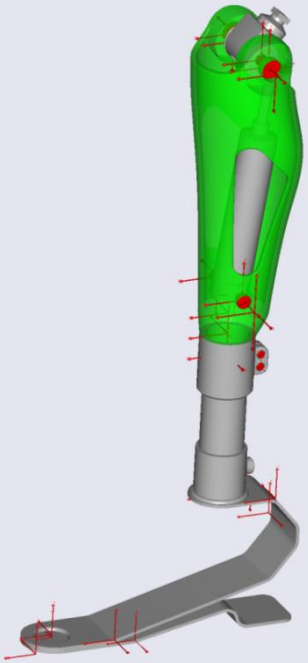
Field of Applications: Rehabilitation

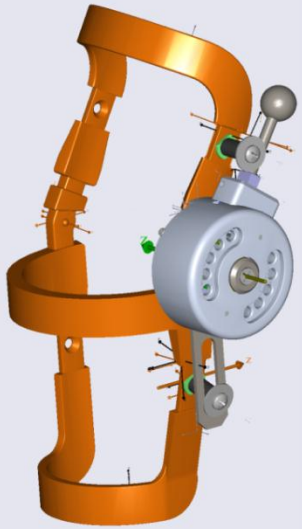
Selected Examples:

- Optimal position of wheelchair axis to reduce loads shoulder
- Optimal design of exoskeletons
- Optimal design/function of amputees



Lelai et al 2012





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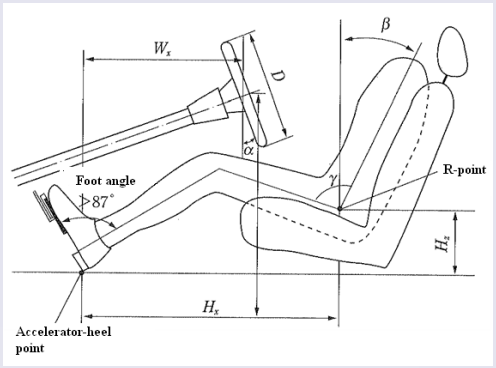
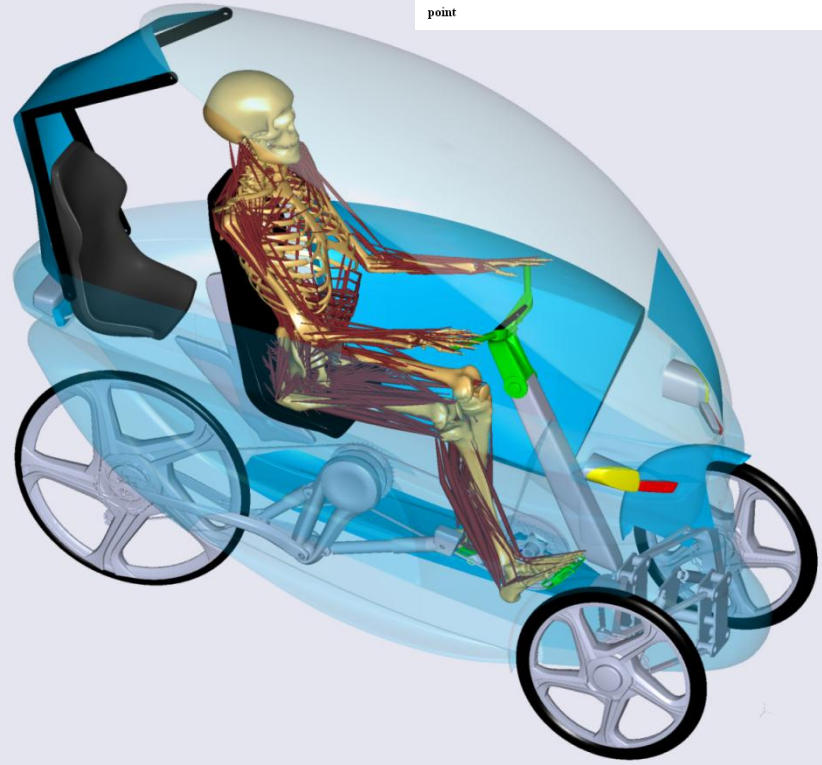
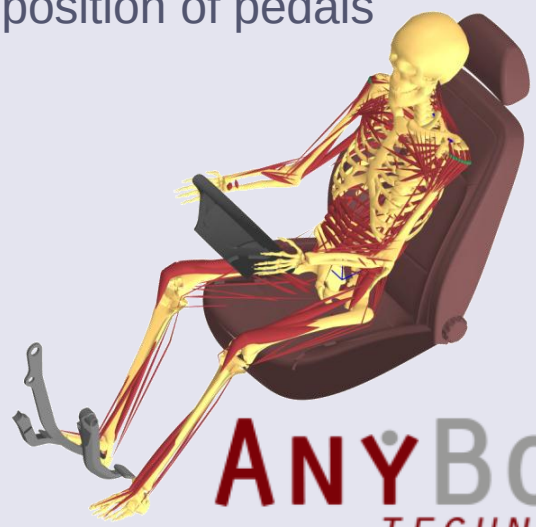
Field of Applications: Vehicle Design



Selected Examples:

- Optimal positions of seat and steering wheel
- Optimal functionality of handbrake or pedals
- Optimal positions of seat height
- Optimal position of pedals





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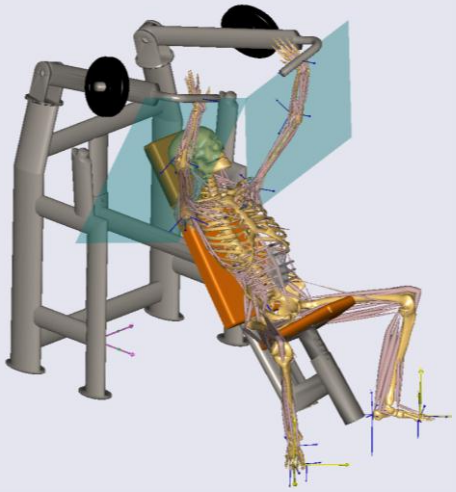
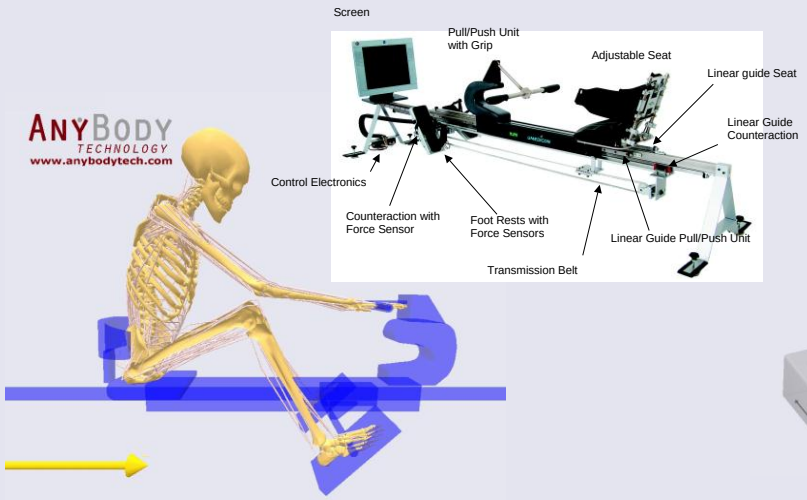
Field of Applications: Sports & Performance

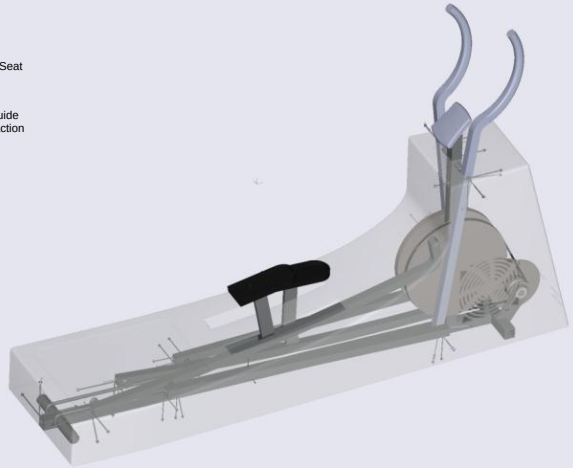


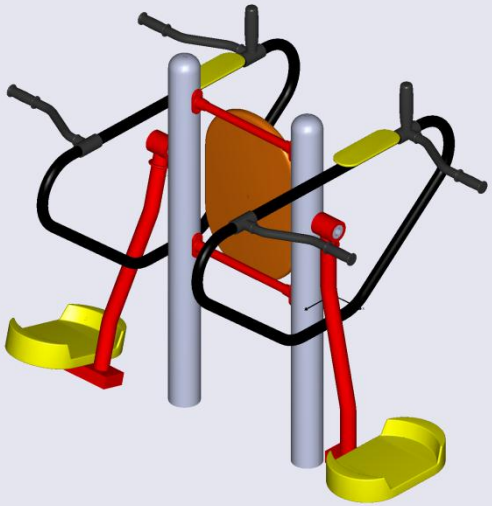
Jung et al 2011

Selected Examples:

- Optimization of dimensions
- Analysis of joint reaction force
- Analysis of metabolic energy consumption







esa

ANYBODY TECHNOLOGY

Summary

SolidWorks2AnyBody Translator

- Short-cut between CAD and musculoskeletal model
  - Geometry, mass properties, mates and references translated
  - AnyScript files are generated automatically

- Closer integration of AnyBody into design process

- Effect of small design changes immediately visible
  - Changes in Joint Reaction Forces
  - Changes in Muscle Activations

- SolidWorks2AnyBody translator is included in AnyBody Modeling System version 5.3

- An additional license is required
  - Please contact sales@anybodytech.com

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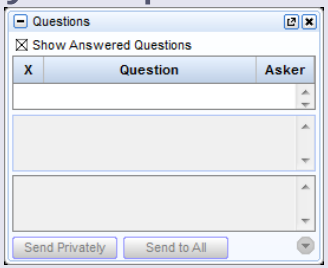
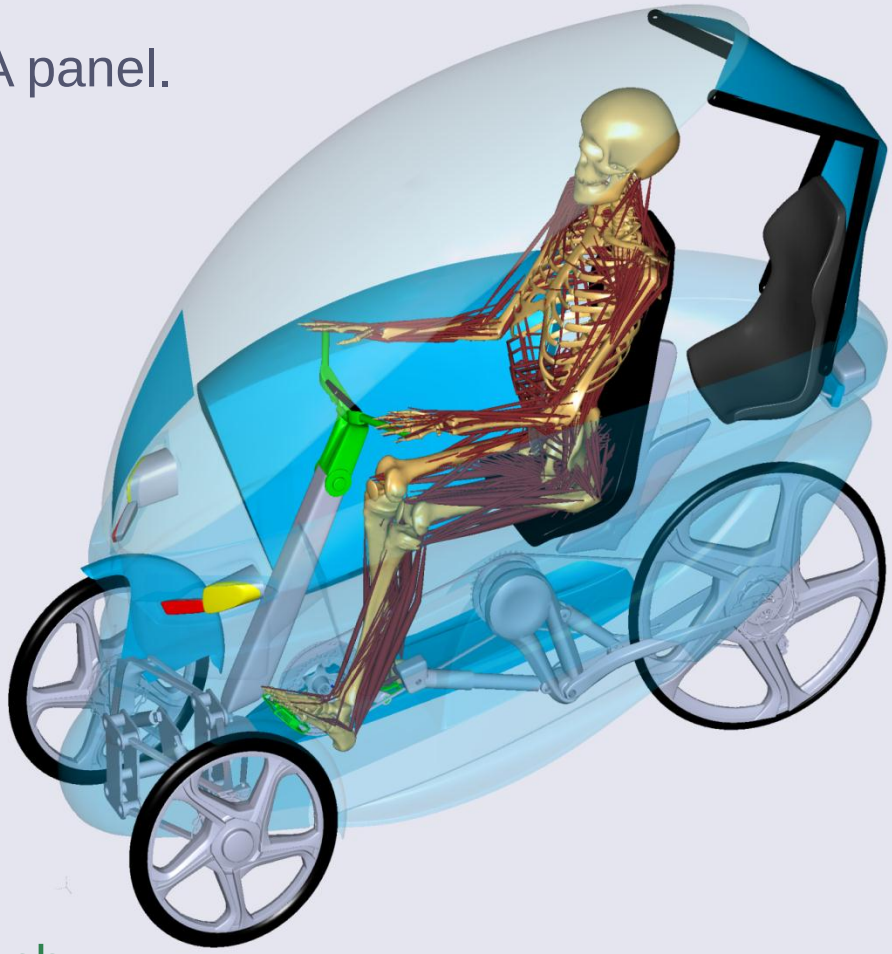
Q & A

You can write your questions in the Q&A panel.





Don’t miss our next webcast:

- 7th Nov: Orthopedic Applications in the Spine

Meet AnyBuddies at:

- 24-27 Oct: NASS 2012, Dallas, TX
- 02-04 Nov: AAHKS, Dallas, TX

YouTube channel of AnyBody:

http://www.youtube.com/user/anybodytech

Contact:

sales@anybodytech.com

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