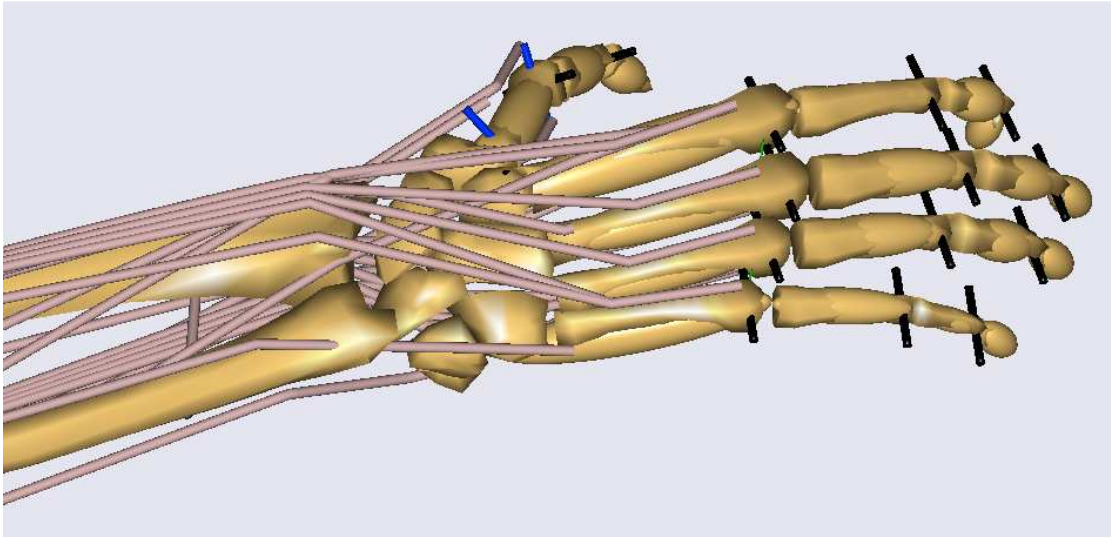
Release notes AMMR V1.2

Body:

Hand:

A new hand model has been added to the model library. The model contains all major muscles spanning the wrist joint. The model is limited in the sense that these muscles do not insert at anatomically correct positions but rather on the metacarpal bones. The muscles do not extend into the fingers, which are all equipped with joint moment generators instead. The hand model can be selected using a switch in the "BodyPartSetup. any" file.



ShoulderRhythm:

A shoulder rhythm linking the motions of Humerus, Scapula and Clavicula has been added to the model.

The rhythm is based on "de Groot, J. H. & Brand, R. (2001): A three-dimensional regression model of the shoulder rhythm. Clin Biomech, 16(9), 735-743." The article links six dofs by linear regression equations, but in the AnyScript implementation we have made use of only five of the equations. One equation was skipped to maintain contact between scapula and the ribcage.

The shoulder rhythm can be enabled through a switch in the BodyPartSetup file in the application.

Arm3D:

The elbow joint has been modified to provide more realistic joint reactions; the kinematics in unchanged but the reactions has been changed. Previously there were three reaction forces between ulna and radius in the proximal pronation/supination joint, now only two reaction forces is present in this joint. The reaction in the longitudinal direction of Radius is instead carried by a new reaction force, acting between humerus and radius.

A few updates have been done to the shoulder muscles. The Sternocleidomastoid muscle that was previously part of the cervical neck model has been moved to the shoulder model as it attach on the clavicula. Also the initial wrapping vectors of the Subscapularis and Pectoralis Major muscles have been modified to make the wrapping more reliable when the initial posture presents important glenohumeral flexion or abduction.

Trunk:

Passive stiffness of the lumbar region has been added. It can be included into included from the Main file. The name of the file to include is "Body/AAUHuman/Trunk/DiscStiffnessNormal.any". The stiffness values introduced originate from "Schmidt et al. (1998): The Stiffness of lumbar spinal motion segments with a high intensity zone in the anulus fibrosus. Spine, 23(20), 2167-2173".

TDLeg (Tweente lower extremity model)

The model has been improved in various ways:

- New bone geometries with a closer geometrical fit to the original TLEM muscle insertion points have been added.
- Initial wrapping vectors for Psoas major muscles have been improved to make it more reliable in all situations.
- Calibration sequences, primarily related to the ankle, have been changed.
- Wrapping of the Gluteus Maximus Superior has been changed.
- The TensorFasciaeLatae1Node attachment node on tibia turned out to be misplaced above knee joint. This error originating from the original data set was changed
- AdductorMagnusDistal1Node, AdductorMagnusDistal2Node and AdductorMagnusDistal3No have been moved to the tibia. In the original data they were located on the femur. The local node coordinate remains unchanged.
- A new node on the foot has been introduced; the node is named "TendonCalcaneousNode" and is used as an attachment point for Soleus and Gastrocnemius. This improves the inversion/eversion moment balance about the ankle significantly.
- The wrapping cylinder for the Psoas muscle has been improved to make it more reliable in all situations.

Mocap

Several improvements have been made in the gait models and a new folder in ToolBox named Mocap has been created. It contains a set of classes that can be used for creating markers and forceplates.

The folder contains the following classes:

- CreateMarkerClass : This class is used for creating markers and drivers for the entire body, except the TLEM leg.
- CreateMarkerClassTD: This class is used for creating markers and drivers for the TLEM leg.
- ForcePlateType2: This class creates a force plate of Type2 . This type of plate needs six channels of data: FX, FY, FZ MX, MY, MZ

- ForcePlateType2AutoDetection: This class is similar to ForcePlate2 but it has automatic detection of which foot is in contact with the plate, thus making it simple to apply to a model. This detection is based on position and velocities of the foot.
- orcePlateType3: The force platform has eight analog outputs, which are combinations of the FX, FY, and FZ measured at the corners of the force platform.
- ForcePlateType3AutoDetection: This class is similar to ForcePlate3 but it has automatic detection of which foot is in contact with the plate, thus making it simple to apply to a model. This detection is based on position and velocities of the foot.
- ForcePlateType4: This class creates a force plate of Type4, needing six channels of data: FX, FY, FZ MX, MY and MZ. In addition it requires a calibration matrix.
- ForcePlateType4AutoDetection: This class is similar to ForcePlate4 but it has automatic detection of which foot is in contact with the plate, thus making it simple to apply to a model. This detection is based on position and velocities of the foot.
- OptimizeAnthropometricsOnOff: This class is used for setting up which anthropometric design variables will be part of the parameter identification optimization.

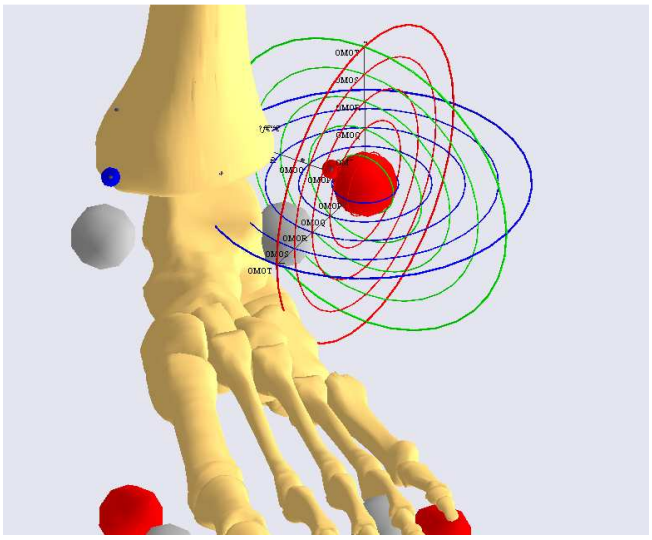
Common to all the create marker classes is that it is now possible to put a weight on each of the markers with respect to the local coordinate system of the node they are attached to. This means that, if you know a certain direction in which the marker coordinate is questionable, for instance due to a large skin artifact, then it is possible to specify a low weight on that direction, thereby reducing its influence on the movement.

A new drawing class named AnyDrawKinMeasure has been introduced in all the marker classes. This drawing object enables visualization of the markers attached to the body and the equivalent free floating markers. Previously, the only way to see the free floating markers was to switch on the "ConstructModel " flag in the AnyInputC3D object, but this entailed a large computational cost due to the many additional degrees of freedom. The only computational cost of the new drawing object is for visualizing the markers in the ModelView.

Circle tool

In some situations you have to know the distances between two reference frames, e.g. when you want to optimize the distance between a measured marker and a body-marker or you may want to adjust a muscle insertion point.
Often you need at least a few iterations to move the reference frames/node to the right position, meaning you have to reload the model again and again, which is time consuming.
This small tool visualizes level curves around a specified reference frame. The coordinates are given in the local reference frame. So you may just read the distances and get the job done with one step.

To do so, you have to include the "ToolBox/Circles/Circles.any" file in the reference frame you are interested in. You can specify the maximum radius and certain graphical settings, like drawing additional spheres, etc.



SelectedOutputs

Due to a change in the rotational measure type of the RevoluteJoint (now PlanarAngles) since version 4.1 of AMS, the values of the reaction moments of this joint are not given in Nm unit anymore. Therefore a direct interpretation of the joint Reaction.Fout is difficult for revolute joints. In order to make it easier, new moment measures have been implemented and the updated values in Nm can be accessed from the SelectedOutput folder as before.

Applications

GaitLowerExtremity:

This application has been updated in several ways:

- The model now makes use of the CreateMarkerTD (class/macro?) It has been developed for creating the markers on the TLEM leg. This class solves the problem of having the markers' optimization directions aligned with the long axes of the bones.
- Dynamic detection of which foot is in contact with the force plate has been introduced by means of the new force plate classes.
- Some of the information previously contained in the ModeSetup.any file has been moved to a new file named TrialSpecificData.any. This has been done to separate trial-specific data, such as anthropometrics and filenames, from data which are not changed between trails using the same experimental setup.

GaitFullBodyModel:

This model contains the same range of changes as the GaitLowerExtremity model.

FreePostureHandSR:

This is a new application which can be used for trying out the new hand and the shoulder rhythm.

FacetJointModel

This model presents a new methodology for implementation of facet joints in the lumbar spine model developed by De Zee et al. (2007: J Biomech. 40, 1219-1227). It enables the facet joint forces to become part of a redundant system of equilibrium equations for the entire system including the muscles. This redundant system is subsequently solved uniquely thereby making it possible to analyze the effect of whole body movements and loads on facet joint loading for the whole lumbar spine together with its muscles.

More details can also be found in the webcast "Implementation of facet joints in a lumbar spine model (Mark de Zee, 25. September, 2008)" it can be found at http://www.anybodytech.com