

Bodybuilder Example Models

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Introduction

The attached files represent examples of the many BodyLanguage models which have been developed and are being used by Vicon customers.

Some of these examples include: Baseball, BothFeetKin, Cumnor_Cleveland, DynaKAD, Flow, Golem, Golf, Johan, Macros, Shank Rotation, SIMMilar, Spine, and University of Miami S Model. For a complete list including descriptions please see the Bodybuilder Example Models.pdf.

We are always interested if you have example models you would like to share with us or others. If this is the case please send a brief description of your model, as well as the model (.mod), marker (.mkr) and model parameter (.mp) files that are relevant via email to: support@vicon.com

UniversityOfMiami_S_Model

AUTHOR: Damon Stambolian, Dr. Shihab Asfour, and Dr. Moataz Eltoukhy, University of Miami Industrial Engineering Biomechanics Laboratory

This full body model was developed at the University of Miami Industrial Engineering Biomechanics Laboratory by Damon Stambolian, Dr. Shihab Asfour, and Dr. Moataz Eltoukhy.

The model promotes an S curve between the head and pelvis by the addition of cervical and lumbar spine and thus is termed S-model.

The Golem model code was modified by addition of the cervical and lumbar spine and addition of other code.

The S-model generates cervical and lumbar spine angles, forces and moments.

Publication: "Using Vicon Bodybuilder and Plug-In-Gait to Generate L5/S1 Angles, Forces and Moments." Damon Stambolian, Dr. Shihab Asfour, Dr. Moataz Eltoukhy, 2014 IEEE Aerospace Conference.

Procedure: First run the static Plug-In-Gait and the static S-model on the static T-pose. Then run dynamic Plug-In-Gait and the dynamic S-model on the motion trail.

Here is a video explaining how to run the model.

<https://www.youtube.com/watch?v=a-Dm-UXzGWU>

Angles

AUTHOR: Vicon Motion Systems

Gives a description of how BodyLanguage calculates joint angles and how to calculate Euler angles.

Baseball

AUTHOR: Vicon Motion Systems

A simple Upper body model that will calculate joint angles, force and moments during a baseball pitch. It includes Kinetics for the mass of a baseball held in the hand along with some code to distinguish between left and right-handed pitchers.

Body

AUTHOR: Vicon Motion Systems

Generates skeleton for full body.

BothFeetKin

AUTHOR: Stefano Taioli

Five segment model for each foot: tibia, talus, calcaneus, midfoot and toe. Uses technical markers and calibrated anatomical landmarks.

Circles

AUTHOR: Vicon Motion Systems

This model generates a circle made of sixteen points with its centre at the specified location and with the specified radius. Alternative code within the same model allows the generation of a circle from 3 points.

ClaudiusV

AUTHOR: Vicon Motion Systems

Full-body kinematics, bones, muscles & kinetics

COP

AUTHOR: Vicon Motion Systems

The model calculates and outputs the Forces and Centre of Pressure from each force plate. The force vector is also calculated and output.

The average of the centre of pressure for the X and Y components of the Force plate is also calculated along with the standard deviation of the X and Y components of the COP. These averages and standard deviations are output to the .mp file.

Cumnor

AUTHOR: Vicon Motion Systems

Full-body kinematics, bones, muscles & kinetics.

Cumnor_Cleveland

AUTHOR: Vicon Motion Systems

Cleveland marker set.

DynaKAD

AUTHOR: Richard Baker

This is a BodyBuilder model which will calculate a thigh rotation value to enter in the VCM based on the assumption that any varus/valgus signal which looks similar to the knee flexion/extension signal is an artefact of thigh wand mis-placement. It will not be reliable if the subject has true medio-lateral instability at the knee or if the subject exhibits a stiff knee gait (in either flexion or extension).

It works on a .C3D file of a walk using the standard VCM marker set. It will work if there are gaps in the data but results are far more reliable with complete data.

Flow

AUTHOR: Chris Kirtley

Calculates inter-segmental power flows.

Foot

AUTHOR: Vicon Motion Systems

A five segment model of the left foot including angle calculation.

FPcorners

AUTHOR: Vicon Motion Systems

Calculate the locations of the corners of a Force Plate from data captured with the calibration L-frame placed on the Force Plate.

GaitLab

AUTHOR: Vicon Motion Systems

Follows the algorithms described in Vaughan C.L., Davis, B.L. and O'Conner J. (1999) The Dynamics of Human Movement, Wiley and Sons.

Golem

AUTHOR: Vicon Motion Systems

Full-body model with kinetics and muscle visualisation.

Golf

AUTHOR: Vicon Motion Systems

This model is provided as an example of a golf analysis model. For further details see the enclosed Golf model Readme.txt.

HelicalMacro

AUTHOR: Vicon Motion Systems

The 'HELICALMACRO.MOD' includes a macro which generates the unit vector representing the direction of the helical axis between two segments, the rotation angle (in deg) between the segments about the axis, the amount of translation between the segments along the axis and also the points at which the helical axis pierces the X=0, Y=0 and Z=0 reference planes.

Johan

AUTHOR: Richard Baker

A full body model to determine the total body centre of mass during the gait cycle of adults and children.

KinBody

AUTHOR: Vicon Motion Systems

Full-body kinetics including lifted weight.

Lifting

AUTHOR: Vicon Motion Systems

This model 'connects' the force required to lift a weight to the right hand and continues the kinetic chain.

Macros

AUTHOR: Vicon Motion Systems

Different macros for 1. Axes visualization 2. Force and Moment normalization 3. Euler angle manipulation. 4. Replace markers based on either 4, 5 or 6 markers. 7. Calculating velocity and acceleration 8. Normalize vectors.

McCoy

AUTHOR: Vicon Motion Systems

Draws all bones (FP draws GRVs)

MovingPlates

AUTHOR: Vicon Motion Systems

Calculates the forces from moving force plates.

MultiFP

AUTHOR: Vicon Motion Systems

The 'MultiFP.mod' includes two macros which together produce outputs which represent the resultant Force and Centre of Pressure (CoP) from multiple force plates (a sequence of up to four force plates in a row).

NonCardanAngles

AUTHOR: Vicon Motion Systems

BodyBuilder defaults to the use of Cardan angle calculations.

Thus, a ZYZ, or other non-XYZ rotation token is not implemented as a standard calculation or function.

However, included in the accompanying ZIP file are two macros that will calculate the three angles alpha, beta and gamma, relating a parent and child segment, output from the default XYZ fixed three-axis BodyBuilder calculation: (child,parent,XYZ).

The macros then construct three vectors representing the lines of the 3x3 rotation matrix describing the orientation of the child segment in relation to the parent.

The final step is the decomposition of the rotation matrix in order to obtain the rotations representing the two-axis output in the order Y-Z'-Y'' or Z-Y-Z'' depending on the macro you choose to use.

This follows a technique available in MATLAB scripts on the International Shoulder Group web page at: <http://www.wbmt.tudelft.nl/mms/dsg/intersg/isg.html>

You may need to modify these macros slightly to account for your particular need.

RHand

AUTHOR: Vicon Motion Systems

The attached model calculates joint angles for the right hand and fingers. Each finger joint is modelled as a hinge across which 'absolute' angles are calculated based on single vector representations of each finger segment. In addition, at the first joint between the finger and hand, the motion is modelled with two degrees of freedom (flex/extension and ab/adduction) with respect to a hand segment.

Shank Rotation

AUTHOR: Vicon Motion Systems

The model calculates Tibial Torsion and Shank Rotation offset using a medial Knee and ankle marker.

Plug in Gait calculates Shank rotation if a KAD is used. This Shank Rotation is used to offset the position of the tibial wand marker to ensure that tibial torsion is taken into account in the Plug in Gait model

The idea with this model is to make use of medial markers to simulate the use of a KAD

SIMMilar

AUTHOR: Richard Baker

Draws stylized muscles and calculates muscle lengths.

SimpleAngle

AUTHOR: Vicon Motion Systems

A model to calculate the angle between two lines defined by 2 points each using a cross-product calculation.

SimpleBody

AUTHOR: Vicon Motion Systems

Simple full body model.

Spine

AUTHOR: Vicon Motion Systems

Makes use of the SPINE function in Body Language to draw vertebrae.

StickTest

AUTHOR: Chris Kirtley

Calculate and show total Centre of Pressure (CP) as a small spot on floor and calculates discrepancy between center of pressure and stick with 2 markers.

Superandre

AUTHOR: Vicon Motion Systems

Converts C3D to Acclaim AMC file.

TwoFoot

AUTHOR: Vicon Motion Systems

TwoFoot.mod, TwoFoot.mp, PlugInGait_TwoFoot.mkr files that extend the single 'Foot' model, also available for download, to both feet.