

Custom Shadow Segments

Overview

Virtual segments provide a convenient way to include multiple definitions for a segment within a single model, but these multiple definitions do not easily allow for external constraints (like an [Inverse Kinematic](#) chain) to be applied consistently across all segment definitions. For example, if a Virtual Segment is defined with relation to a segment and then an Inverse Kinematics constraint is applied to the original segment, the changes in the original segment's pose estimation do not propagate to the Virtual Segment.

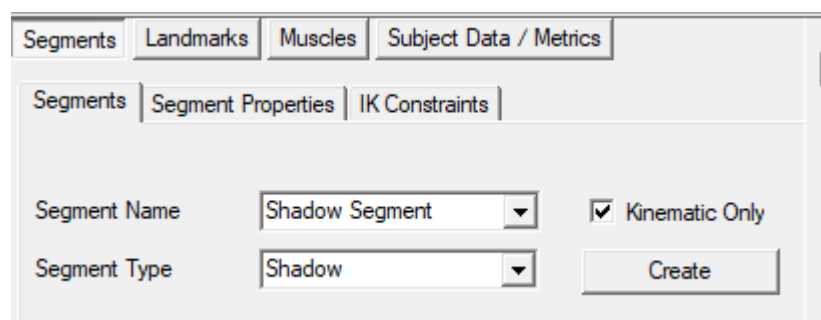
Shadow segments resolve this issue by allowing that segment's pose to be defined as a transformation of the original segment's pose estimation. Users can use the [Expression](#) function [Pose_4x4](#) when defining their own shadow segments.

This tutorial will demonstrate how to create custom shadow segments and how they can be used.

Segment Definition

The shadow segment must be defined based on a pre-existing segment therefore, before continuing ensure you have a model with a already defined segment that you wish to shadow.

Once this segment is creating you create this segment the same way as any other by going to the **Segments** tab of your model. Type in your desired shadow segment name (often Shadow Segment), change the segment type to shadow. select Kinematic only and press create. When using a shadow segment, it should not be used in the kinetic chain as they are primarily reference segments rather than physical body segments. As they don't have any mass and inertial properties they should not be included in the kinetic chain.



The screenshot shows a software interface with a 'Segments' tab selected. Below it, the 'Segment Properties' sub-tab is active. The 'Segment Name' field contains 'Shadow Segment' and the 'Segment Type' dropdown is set to 'Shadow'. The 'Kinematic Only' checkbox is checked. A 'Create' button is located to the right of the 'Segment Type' dropdown.

Once created you will be automatically taken to the new shadow segment tab. First select the shadow you wish to shadow (The pelvis will be used for this example). Now you must define the 4x4 rotation which is the heart of defining the shadow segment. More information on this command can be found [Here](#). The following shadow pelvis would adjust the X coordinate rotation by 10 degrees. The first three zeros would be for translational changes and the second three are rotational. The next conditions are just further defining the new segment with 0.1 chosen for the radius as it is a common default value.

Segments | Segment Properties | IK Constraints | Shadow Pelvis

X

Segment to ShadowPelvis

Copy Segment Properties to Shadow Segment

Rotation 4x4POSE4X4(0,0,0,10,0,0,123)

Rotation 4x4 wrt SCSPelvis

Segment LengthRPV_SEG_LENGTH

Proximal Radius0.1

Distal Radius0.1

DepthRPV_DEPTH

Example ExpressionsPOSE4X4(R_HEEL,0,0,0,123)

Close TabApplyBuild Model

You should now be able to see your shadow segment in your model. In this example the new segment rotated 10 degrees about the segment X-axis from the original.

Analysis

Shadow segments are often used in comparison to the anatomical results. Due to shadow segments not being part of the kinetic chain only kinematic analysis can be done on these segments.

Here are some samples analysis that can be done on a shadow segment:

[Joint Angles](#)

[Joint Velocity](#)

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