

Virtual Segments

We have grown accustomed to referring to **Kinematic Only** Segments as **Virtual Segments**. The defining criterion for distinguishing a **Virtual Segment** from other segments in Visual3D is that these segments do not get included in the Inverse Dynamics calculations. These segments cannot be assigned external forces and will not have **Joints** created at their proximal end points.

Virtual Segments are not actually segments as the term is commonly used but are actually a convenient way of identifying local coordinate systems (**Segment Coordinate Systems**)

Virtual Laboratory

For example, Virtual Laboratory Segments are often created to provide the means for accommodating segment angles (such as the pelvis or the foot) relative to the direction of walking. This means that it doesn't matter which direction the subject is walking because the path of progression can be defined explicitly. Below are some pages that detail how one would define a virtual lab that is in a different direction from the lab coordinate system as well as how one would define a virtual lab that changes direction with walking progression.

- [Creating a Virtual Laboratory: Example 1](#)
- [Example: Virtual Lab](#) - Example2.cmo
- [Example: Virtual Lab That Changes Direction](#) - Example3.cmo

(The Virtual Lab is also explained on the [Virtual Lab Tutorial](#))

Absolute Joint Angles

Once the virtual laboratory segment has been created, you can create an absolute angle (segment angle relative to lab).

- Refer to this page to create [pelvis segment angles](#) from virtual lab segments.
- Another example is foot progression angle.
 - The first step is to build a **Virtual Foot** Segment for the right and left feet as described in [Normalized Joint Angle - Method 1](#).
 - The second step is to compute a Joint Angle. Assuming that you are using the default Laboratory Coordinate System and the subject is walking in the anterior direction of the laboratory (e.g. Y), the Right Foot Angle can be defined as:

DataName: **Right_Foot_Angle** Folder: **ORIGINAL** Model Based Item Properties: **JOINT_ANGLE**
Normalization: **Normalization Off** Segment: **Right Virtual Foot** Reference Segment: **LAB** Cardan Sequence: **X-Y-Z**

In this example, the foot progression angle would be the rotation about the z-axis of the laboratory.

If your subject is walking in a different direction, you will need to create a Virtual Laboratory Coordinate system that is aligned to the direction the person is walking.

Another common use is for [Normalizing Joint Angles](#). Normalization is the process of referencing a joint (or segment) angle to the reference posture. In Visual3D the reference posture is the static trial used for the link model. We usually recommend the use of virtual segments, which can be defined so that they explicitly cause the static trial to be a reference posture.

Virtual Segments for Comparison

Virtual Segments are a good way to compare segment model variations. Visual3D will allow multiple segment definitions. A user/researcher may examine the differences between these segments by creating multiple virtual segments.

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