IMD4003
3D Computer Animation

G03 – Correcting Animation in MotionBuilder

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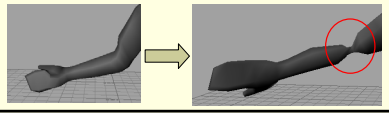
Contents

Overview

- This document covers how to correct animation (specifically rotations) in MotionBuilder based on the fact the input will be a control rig from motion capture data …

Rotations

- Introduction
  - Rotations can be a nightmare from Motion Capture data because they are not easily visible until you have applied the control rig to a skinned character
  - Once they are applied, we end up with twists (mainly at elbow joints, but also wrists and knees too); an example is shown below



Rotations

- Introduction
  - We can correct this using several methods, but we shall cover 3 of the easiest methods here (at least easiest to explain)
  - First, let's look at the problem; the problem usually consists of +/- flip, so one key frame the rotation for a specific axis is positive and the next it is negative
  - In general, this doesn't have to be the same value on either side (although sometimes it can be indicating a gimbal problem), but just a "crazy" rotation

Rotations

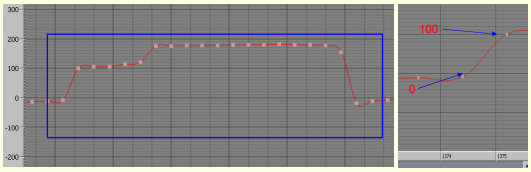
- Introduction
  - What is a "crazy" rotation?
  - Well, let us look at the normal limits of the arm; in general our elbow for example will rotate between +65 and -65 degrees (approximately 130 degrees rotation end-to-end)
  - A crazy rotation would be between two frames approaching or greater than this (so certainly a difference in rotation of 200 degrees would be considered "crazy")

Rotations

- Introduction
  - Another “crazy” rotation would be outside the joint limits; as previously discussed the limits are about +65 to -65, so if the rotation is further than this, then it is going outside the limit
  - However, this relies on the fact that the 0 degree rotation point is where the palm is flat to the floor (in the T-pose) which often it’s not
  - Therefore, you have to use your own judgment here …

Rotations

- F-Curves
  - If we look at the example twist using F-Curves (which is on the “Navigator” Window or can be accessed through the menu: “Window” → “FCurves”) we can see this disaster:



Rotations

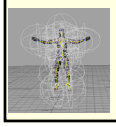
- F-Curves
  - We can see in the previous slide that the curve is nice and steady at almost 0 degrees and then in almost less than 1 keyframe it shifts to 100 degrees (very fast) and then 5 keyframes later it shifts another 100 degrees
  - Well, if 0 is the centre of the rotation then we should be expecting a maximum of +/- 180 limits (which does limit us) but this is an extreme and therefore unexpected
  - This is also the rotation on the elbow joint, thus impossible for a normal human …

Correction Methods

- Introduction
  - So, how do we correct this? It is import to preserve as much data as possible without leaving this impossible rotation in our animation sequence
  - Here we introduce 3 methods
    - Degree of Freedom Limits
    - Data Filtering
    - Key Frame Correction of FK

Correction Methods

- Setting Up the Character
  - First, you obviously need to load in your character into MotionBuilder
  - Once that is done, click on the “viewer” window and under the “Display” drop-down menu (top/left) select “X-Ray”
  - If you end up with a lot of circles surrounding your joints (sometimes yes, sometimes not) then you can turn them off by using “Display” → “Models Visibility” and uncheck “Skeletons”

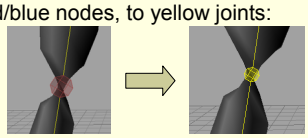


Correction Methods

- Setting Up the Character
  - In general, we can scroll through the timeline until we get to the problem that we need to correct
  - At this point, it is best to select the joint that is causing us this problem in order that we can edit its properties
  - Before we do that, we need to turn off the IK control elements; we do this under the “Character Controls” window:
    - “Show” dropdown menu → uncheck “IK”

Correction Methods

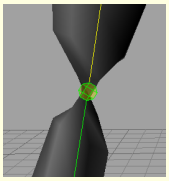
- Setting Up the Character
  - Our character's joints should turn from red/blue nodes, to yellow joints:



  - This is an important step, because if we are not working on the FK skeleton, then whatever we do is in vain …

Correction Methods

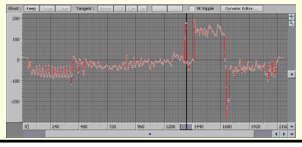
- Setting Up the Character
  - Next, we need to select the joint, this should turn the joint and the child bone green



Correction Methods

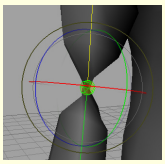
- Setting Up the Character
  - If we look in the F-Curves editor, we can select either the rotation, translation, or scaling for that joint (and the individual axes)
  - We can view each axis in turn (and almost see where the problems lie, as they go outside the normal curve)

This is the curve for the X-rotation selected



Correction Methods

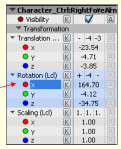
- Setting Up the Character
  - We can see that the colours correspond to the XYZ values (X = Red, Y = Green, Z = Blue)
  - Depending on how the model was created, will depend on what is pointing where, here we can see x is pointing down the bone in the local coordinate system; and y and z are point out to the left and back respectively



Correction Methods

- Key Frame Editing/Removal
  - First, we need to determine which axes (if there is only one) is in error, we do not want to delete or edit data that are not problematic
  - So, determine the axis, and then select it/them in the FCurve Editor

Here we have selected the x-axis which is the cause of the twisting (twisting is generally caused by the axis that is point down the bone)

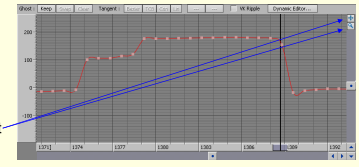


Correction Methods

- Key Frame Editing/Removal
  - Next, we need to get to the frame set that we have the problem and expand the curve to show those keyframes

MotionBuilder can use the same keyboard/mouse functions as Maya and Vicon, so "Alt" + "MMB" gives you a shift up/down and left right, and "Alt" + "RMB" gives you zoom X-axis and Y-axis

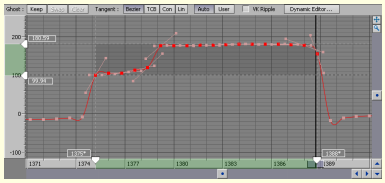
Alternatively you can use the icons in the right corner (click and hold)



Correction Methods

- Key Frame Editing/Removal
  - Next, we need to select the key frames we want to correct; so using the “LMB” select only those keyframes that we consider to be in error

MB will highlight them for us (even showing the tangents)

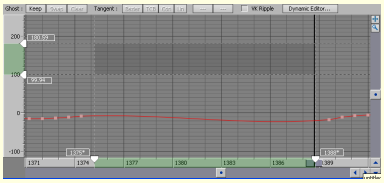


Correction Methods

- Key Frame Editing/Removal
  - Now, we can simply delete (press delete, or “RMB” → “Delete”) them from the sequence, which will make a the majority of the correction

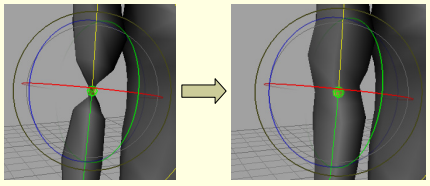
We should see the curve flatten nicely, as it now interpolates between those two good frames

If you obtain weird curves, you might need to step a few KF back



Correction Methods

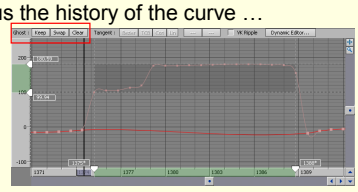
- Key Frame Editing/Removal
  - We can also see that the model is untwisted, which is what we wanted …



Correction Methods

- Key Frame Editing/Removal
  - Another thing we can do is we can see where the curve was, and where it is now; this is done using “Ghost”
  - If we press “Keep” next to “Ghost”, it will show us the history of the curve …

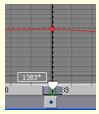
Pressing clear will then clear the history if we are finished with it



Pressing swap will swap the effect of the two curves (previous and current)

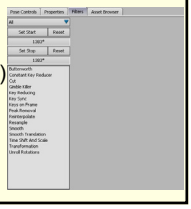
Correction Methods

- Key Frame Editing/Removal
  - If we need to edit curve we have just cleared, we can always add a key
  - We simply slide the time slider (in F-Curves it’s easier because the time frame is smaller) to the position, and then “RMB” → “Insert Key”
  - We can then edit the position of this key to change the rotation of along that axis



Correction Methods

- Key Frame Editing/Removal
  - If we are going to edit a keyframe (rather than adding one to a cleared set) then we might consider filtering the keyframes to reduce the overall number
  - In order to do this we bring up the Filter Window (menu → “Window” → “Filters”)
  - Here we can filter the curves easily and apply it to a selection or to all …



Correction Methods

- Key Frame Editing/Removal
  - Now, we can set the Start and End to the start and end of the sequence because we are going to use “Key Frame Reducer” which should be able to be applied to all keys
  - We can also set the selection to “All” as shown below; this applies it to all curves (if we require something specific, we can set it here)

Correction Methods

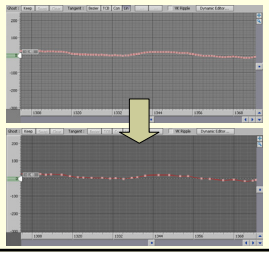
- Key Frame Editing/Removal
  - Click “Key Reducing” and leave the default value of 1.0 for the Precision
  - We can now click “Preview” to see how the keyframes are affected, if we are not happy just click “Reset” or we can click “Accept” if all looks well … if we don’t want to apply at all, we can press “Cancel”

Correction Methods

- Key Frame Editing/Removal
  - We can see our key frames are reduced (as long as we have the window framed properly)

MotionBuilder has determined which keyframes are important and removed the others (greatly reducing the data)

We can now edit the keyframes we want as we have seen previously



Correction Methods

- Filtering
  - Filtering can be useful to edit noise and there are other functions there (which should be used with care)
  - We can apply these filters on the entire set of frames, and all curves, or just a selection (which is more appropriate)

Correction Methods

- Filtering
  - The filters worth looking at are:
    - **Peak Removal** ~ which can removal spikes and peaks in your curves (often caused by errors in the data happening over 1 frame)
    - **Butterworth** ~ which sets the frequency in order to perform a noise removal function (similar to the Butterworth filter used by Vicon)
    - **Gimbal Killer** ~ if you are suffering from Gimbal problems, this can remove them (sometimes)

Correction Methods

- Filtering
  - The filters worth looking at are:
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    - **Gimbal Killer** ~ if you are suffering from Gimbal problems, this can remove them (sometimes)
  - All filters are subject to the conditions that exist, but they are easy to try and rest if you wish to see what happens…

Correction Methods

- Degree of Freedom Limits
  - Lastly, another method which can help us correct some of the problems is to set the "degree of freedom" limits
  - Here we set the joint limits of each joint and thus limit the effect that a rotation has (note this doesn't recompute the Kinematics, it simply limits an input rotation from the control rig)

Correction Methods

- Degree of Freedom Limits
  - In order to switch on DoF limits, we need to open the Properties (menu → "Window" → "Add Properties Editor") but it might already be up (near "Filters")
  - Each joint you select has different properties, so make sure you have selected the joint you wish to set the DoF on
  - Expand the joint, so you see "Visibility", "Transformation", etc and expand the tab "Degrees of Freedom" and you should see "Translation", "Rotation", and "Scaling"

Correction Methods

- Degree of Freedom Limits
  - Open the tab "Rotation"
  - Firstly, if we want to enable DoF, we need to check the box called "Enable Rotation DoF"
  - Next, if we want to enable Limits, we need to check the box called "Enable MB5.5 Limits" this is simpler to understand than using "Pre-Rotation" etc
  - Now we have tabs for "Min R" and "Max R", we can open both

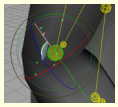
Correction Methods

- Degree of Freedom Limits
  - Here, we can limit each axis (X, Y, and Z) and switch them on/off using the check boxes
  - The values (here shown as 0.00) can be set for the minimum and maximum values
  - When we adjust them, we shall see that if our model is outside those limits, it will shift the joint accordingly

Correction Methods

- Degree of Freedom Limits
  - One useful thing we can do is check "Show DOF Icon" and set the "DOF Icon Size" to "5.00"
  - This will show the limits on the joint itself, in addition when we set the min/max values it will show those on the joint (which is useful for us to see how it will affect the joint)

Y = 29/-45



Y = 29/33