Intersegmental Model for calculating 3D Angular Kinematics

**Step 1:** **Export Data**

Data should be exported from Motive after it has been cleaned in Motive.

**Step 2: Correct\_Marker\_Blips.m**

Correct\_Marker\_Blips(filePath);

where filePath is either a file exported by Motive or a folder containing Motive files

Options

‘nameString’ (default = ‘\*csv’): is only used with folder input. It only performs the function on files containing the specified string where \* is a wildcard.

‘thresh’ (default = 10): files do not need cleaning if the marker accelerations (in m/s2) never exceed this threshold. Set to -1 to force visualization of all data files

If any marker acceleration exceeds the threshold, then a figure displaying the marker displacements vs frame #, marker accelerations vs frame #, and the max marker acceleration vs marker # will pop up. If it looks like a marker has an issue, then you can click ‘interpolate’ in the option menu and you’ll be asked to use ginput to select the start and end frames of the problem area. Linear interpolation is used between these indexes. Then you input which marker # is to be fixed. You can do this as many times as you’d like to fix all the issues for a given trial. If you make any changes, then the file will be overwritten with the corrected data (unless you quit).

**Step 3: Motive\_Spine\_Marker\_Sorting.m**

Will sort the markers based on a grid system and output the folder to a new folder called /Sorted/

Correct\_Marker\_Blips(filePath);

where filePath is either a file exported by Motive or a folder containing Motive files. These should already have been cleaned.

Options

% sortOrder (optional) specifies the order of the rows that the program

% should sort along. Default is [2,1] because most likely the

% superior/inferior axis is along 'y' and the mediolateral

% axis is along 'x'. The program does not sort along the third % axis (AP ‘z’).

% For headers to work +x should be Left, +y = Up, +z = Ant

% nColumns (optional) number of columns in the grid (default = 3)

% startLvl (optional) type cell: {'S1'} default. First spine level of

% markers starting from the bottom

% missingMrk (optional) is an array of markers that are missing in the

% grid. Each row is a missing value. Column1 is the Column#

% (Left, center, right) and column2 is the spine level.

% default is [];

% gridSize (optional) gives the number of columns and spine levels. If

% default [], grid size will solve based on number of markers.

% visualize (optional ‘on’ or ‘off’) to see a labelled figure of the

% back. If visualized, data will not write to file unless the

% user accepts the sorted data.

% default = ‘off’;

**Step 4: Intersegmental\_Spine\_Model.m**

Intersegmental\_Spine\_Model(filePath);

where filePath is either a file or folder of files exported by Motive\_Marker\_Sort.m.

Options

% nameString (optional - default: '\*csv'): Only performs the function % on files containing the 'nameString'

% outFreq (optional - default: 30): Target frequency of the data

% written to file

% lcsLevels (optional - default: [1,19]): LCS that are calculated

% between the indices specified (S1 == 1 and C7 == 19)

% includeLevels (optional - default: [1,19]: This option will drop

% marker data from spine levels outside of 'includeLevels'. % Can be used to calculate lower T9-S1 model for males. This % is done before padding.

% nPadding (optional - default: 3): Number of padded rows of markers

% included at the top and bottom of each column.

% nKnots (optional - default: 6): specifies the number of knots

% used in the piecewise polynomial where,

% segments = nKnots - 1;

% The original ABME paper used 6 knots across 21 levels

% yielding 4.2 markers/segment (21 / (nKnots-1) ). I don't

% think it's a good idea to go below 4 markers/segment

% because then the spline is too flexible (can go through

% every point).

% visualize (optional - default: 'off'): Can be used to look at the

% scatterplot of markers from the first frame. LCS are not % calculated if this is 'on'.

% writeToFolder (optional - default ' \IntersegmentalLCS\'): name of

% the folder created to output data. This is always a child % folder of the input folder.

% startLvl (optional - default 'S1'): First Line of Spine Markers

**Step 5: LCS to Angles**

% This function reads in a file or folder of data output by

% Intersegmental\_Spine\_Model.m function and performs the following steps.

% 1) The Intersegmental, Total (C7/S1), Thoracic (C7/T12), and Lumbar

% (T12/S1) Cardan Angles are calculated.

% 2) Positions and Angles are low pass filtered

% 3) Whole time series are time normalized to include the same number of frames.

% Input:

% filePath (required): can be a file or folder

% nameString (optional - default: '\*csv'): Only performs the function

% on files containing the 'nameString'

% outFrames (optional - default: 400): Number of frames written in

% output

% writeToFolder (optional - default ' \Processed\'): name of the

% folder created to output data. This is always a child

% folder of the input folder.