Altair

HyperWorks

Altair HyperMesh 2019 Tutorials

HM-4645: Seatbelt Routing

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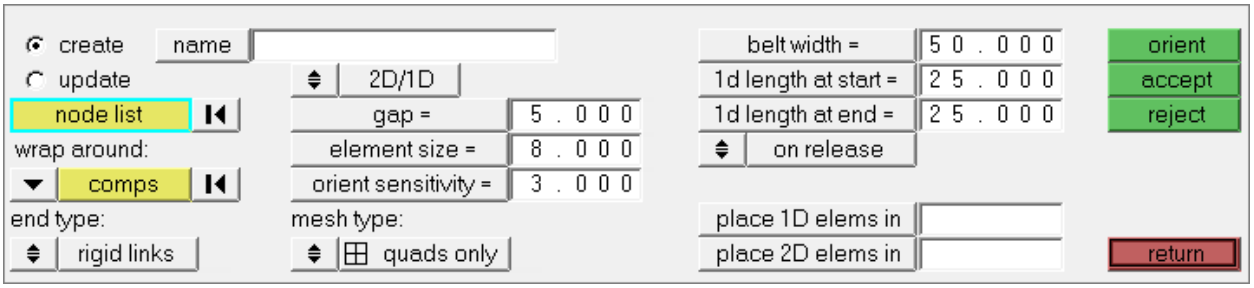
Before starting this tutorial it is recommended that you complete the introductory tutorial, HM-1000: Getting Started with HyperMesh.

Model Files

This tutorial uses the `SEAT_MODEL.hm` file, which can be found in `<hm.zip>/interfaces/lsdyna/`. Copy the file(s) from this directory to your working directory.

Seatbelt Routing

From the **Analysis** page, select the ***Safety*** panel and click ***belt routing*** to access the **Belt Routing** panel. Use the **Belt Routing** panel to create seatbelt segments that wrap around a dummy's torso or lap.



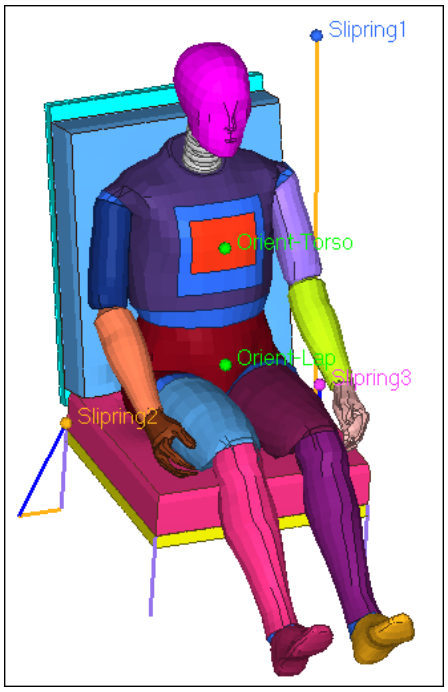
Belt routing panel

Exercise

Step 1: Create a shoulder belt

1. From the menu bar, click ***File*** > ***Open*** > ***Model***.
2. In the **Open Model** dialog, navigate to your working directory and open the file `SEAT_MODEL.hm`.
3. From the **Analysis** page, click ***safety*** > ***belt routing***.
4. Go to the ***create*** subpanel.
5. Using the **node list** selector, select ***Slipring1***, ***Orient_Torso***, and ***Slipring2***, respectively. These nodes will be used as orientation nodes to guide a smooth profile belt.

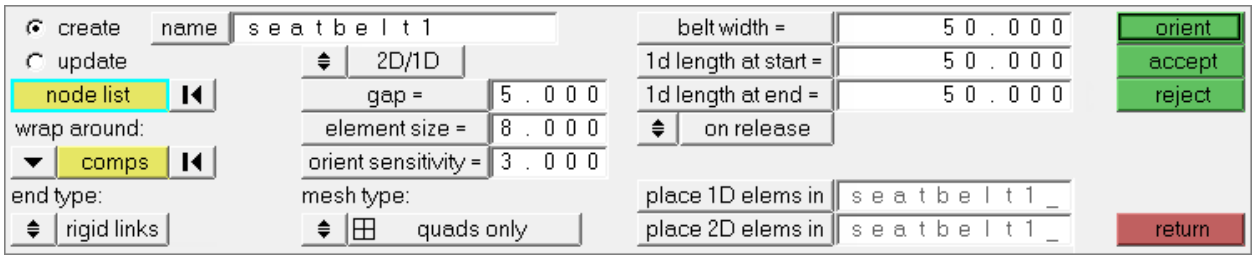
   Tip: To display the node attached to each tag, click on the **Visualization** toolbar, click in the **Visualization** tab, and then set **Tag icon** to ***Text and Icon***.



6. Activate the **wrap around: comps** selector.
7. Click ***comps***.
8. Click ***comps*** >> ***by assems***.
9. Select the assembly, ***Torso-Belt***.
10. Click ***select***.
11. Click ***return***.
12. Set the **2D/1D:1D** toggle to ***2D/1D*** (default) to create a combination of linear and plate belt elements.
13. For **belt width**, enter `50.0`.
14. For **1d length at start**, enter `50.0`.
15. For **1d length at end**, enter `50.0`.
16. For **element size**, enter `8.0`.
17. For **gap**, enter `5.0`.
18. For **orient sensitivity**, enter `3.0`.
19. Double-click ***place 1D elements in***, then select a collector to place 1D elements.

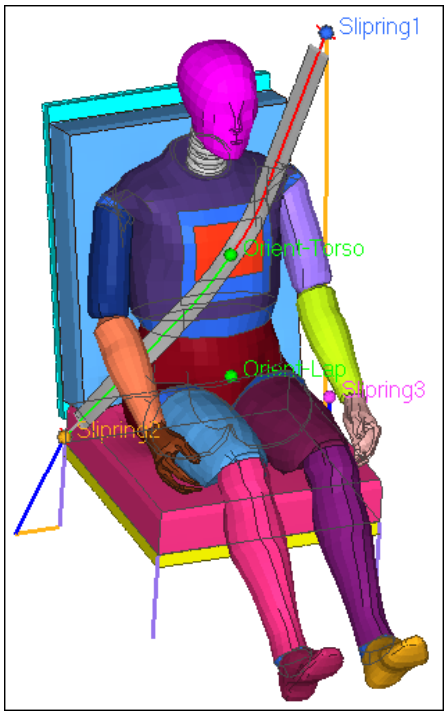
    Note: If nothing is selected, HyperMesh will create the collector **seatbelt1_1D**. By default, this collector is assigned the property *SECTION_SEATBELT and the material *MAT_SEATBELT (along with loading and unloading curves for forces vs. engineering strain).
20. Double-click ***place 2D elements in***, then select a collector to place 2D elements.

Note: If nothing is selected, HyperMesh will create the collector **seatbelt1_2D**. By default, this collector is assigned the property *SECTION_SHELL with a thickness of 1.20mm and the material *MAT_FABRIC.

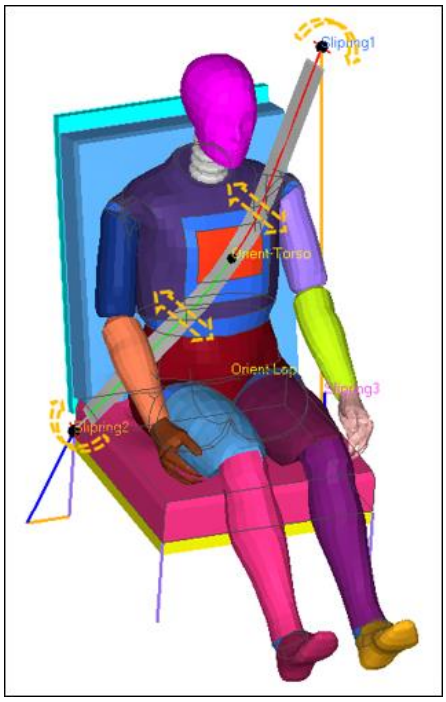


Belt routing panel settings

21. Create the belt by clicking ***orient***. A preview of the full belt representation with multiple red and green line segments (two lateral lines at the ends of the belt, and additional lines along the length of the belt) displays.

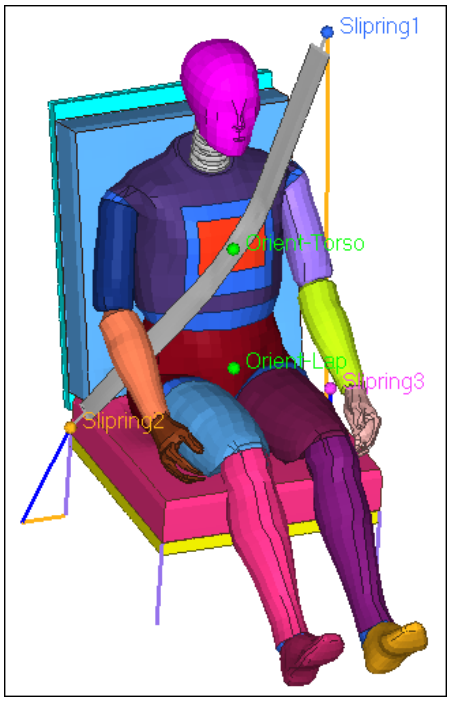


22. Select each line segment and interactively control the profile and smoothness of the belt by rotating the lateral end segments, or moving and placing lines segments along the length of the belt. Once a final position is achieved, release the mouse to create a mesh that follows the specified path.



23. Once the belt is properly oriented, click ***accept*** to create seatbelt1.

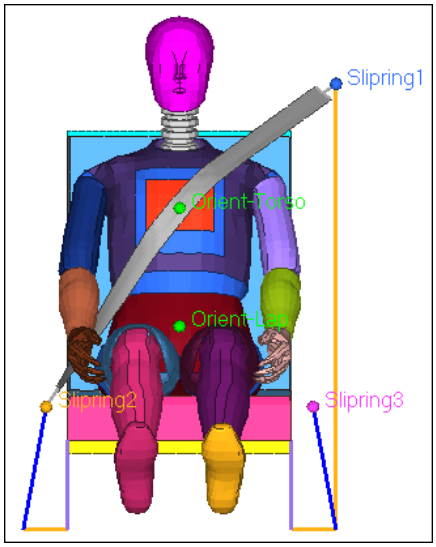
    Note: Transition between shell and liner elements for seatbelt1 by setting the **end type** toggle to rigid links or tria surfaces. Transition between quads and R-trias elements for the seatbelt mesh using the **mesh type** toggle.



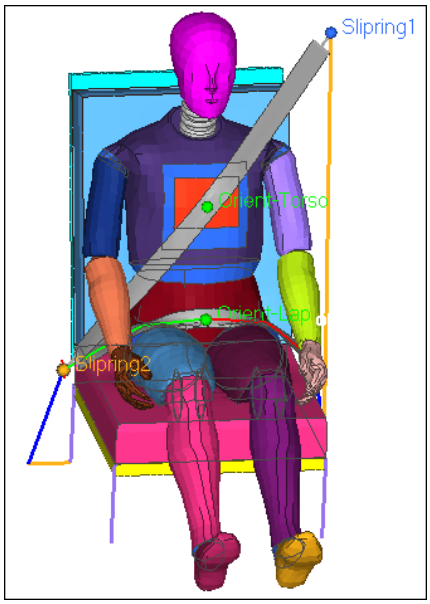
Step 2: Create Belt Segments that Wrap Around the Lap

The steps for creating belt segments that wrap around the lap are similar to the steps for creating belt segments that wrap around the torso. When creating belt segments that wrap around the lap, you must select new end points and lap components.

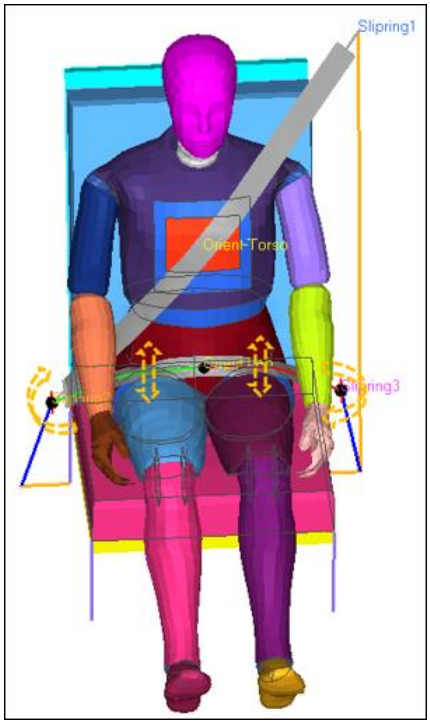
1. Using the **node list** selector, select ***Slipring3***, ***Orient_Lap***, and ***Slipring2***, respectively. These nodes will be used as orientation nodes to guide a smooth profile belt.



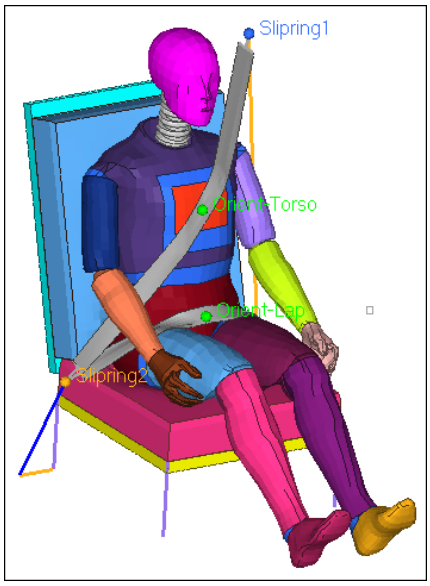
2. Activate the **wrap around: comps** selector.
3. Click  to clear any previously selected components.
4. Click ***comps***.
5. Click ***comps*** >> ***by assems***.
6. Select the assembly, ***Lap-Belt***.
7. Click ***select***.
8. Click ***return***.
9. Create the belt by clicking ***orient***. A preview of the full belt representation with multiple red and green line segments (two lateral lines at the ends of the belt, and additional lines along the length of the belt) displays.



10. Select each line segment and interactively control the profile and smoothness of the belt by rotating the lateral end segments, or moving and placing lines segments along the length of the belt. Once a final position is achieved, release the mouse to create a mesh that follows the specified path.



11. Once the belt is properly oriented, click ***accept*** to create seatbelt2.



Step 3: Modify the Seatbelt Using the Belt Routing Panel or the Entity Editor

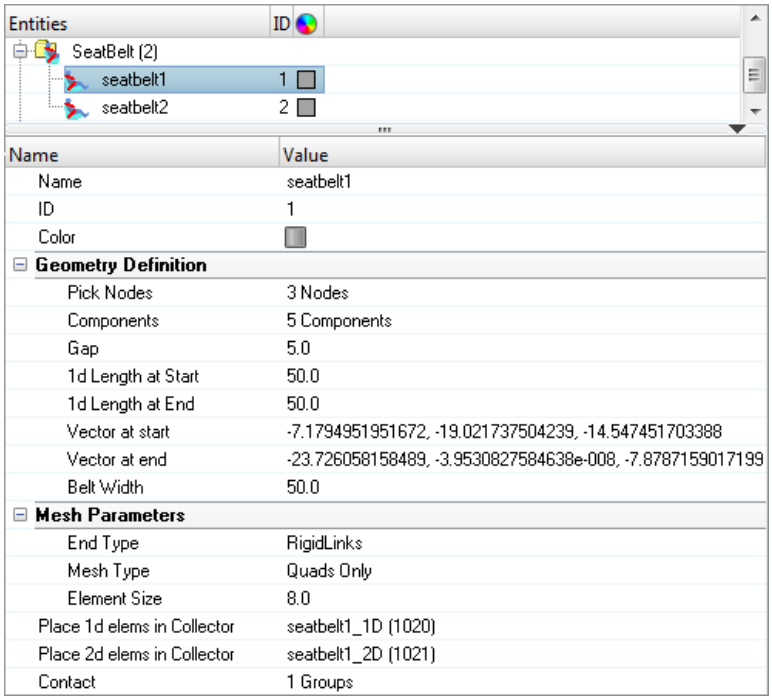
Panel:

1. From the **belt routing** panel, go to the ***update*** subpanel.
2. Click ***name***.
3. Select the seatbelt to be modified.
4. Modify the seatbelt's parameters accordingly.
5. Select each line segment to interactively orient them to a specific location. Once a final position is achieved, release the mouse to create a mesh that follows the specified path.
6. Once the belt is properly oriented, click ***accept***.

Entity Editor:

1. In the **Model** browser, **SeatBelt** folder, select the seatbelt to be modified. The **Entity Editor** opens, and displays the seatbelt's corresponding data.
2. Interactively modify the seatbelt and orient it to a new location by:
   - Clicking ***Pick Nodes***, and using the **Nodes** selector to reselect nodes.
   - Clicking ***Components***, and selecting a new component to wrap the seatbelt around.

3. Modify the seatbelt's parameters accordingly.



Entity Editor open for seatbelt1

7. By default, the contact *CONTACT_AUTOMATIC_SURFACE_TO_SURFACE is created for each seatbelt entity. The **seatbelt_2D** component is assigned as the slave, and the component selected for **wrap around** is assigned as the master.
8. In the **Solver** browser, ***CONTACT**, ***CONTACT_AUTOMATIC_SURFACE_TO_SURFACE** folder, right-click on **seatbelt1_contact** and select ***Review*** from the context menu to review the contact.