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HyperWorks

HM-4640: Dummy Positioning

In this tutorial, you will learn the different functionalities available in Default to position a dummy in its environment.

- H-Point positioning
- Manual and automatic positioning of dummy limbs
- Save/retrieve dummy positions
- Link a dummy to a seat mechanism



Model Files

The driver seat and environment used in this tutorial are based on the LS-DYNA Toyota Yaris model, provided on the National Crash Analysis Center (NCAC) website.

The LS-Dyna dummy model used in this tutorial is a release version of the THOR-Mod Kit/Metric crash test dummy with SD3 shoulder posted on the NHTSA website.

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

Exercise

Step 1: Open HyperMesh with the LS-DYNA User Profile

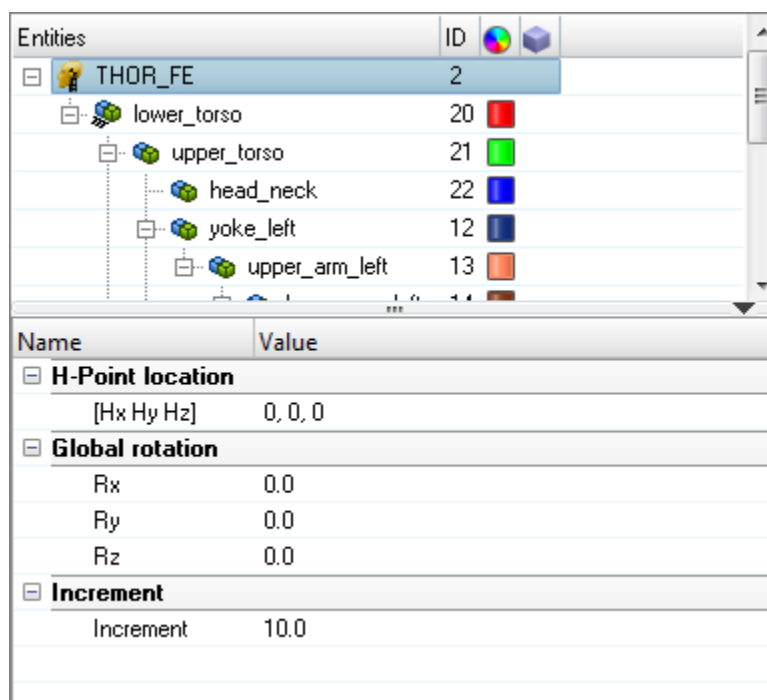
1. Start HyperMesh Desktop.
2. In the **User Profile** dialog, set the user profile to **LsDyna, Keyword971_R8.0**.


Step 2: Load the Model File

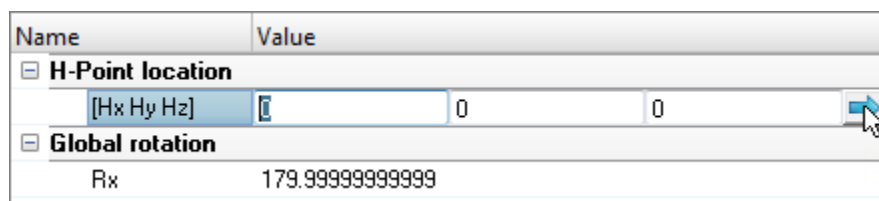
1. From the menu bar, click **File > Open > Model**.
2. In the **Open Model** dialog, navigate to your working directory and open the file `dummy_positioner.hm`.

Step 3: Position the Dummy to its H-Point Location

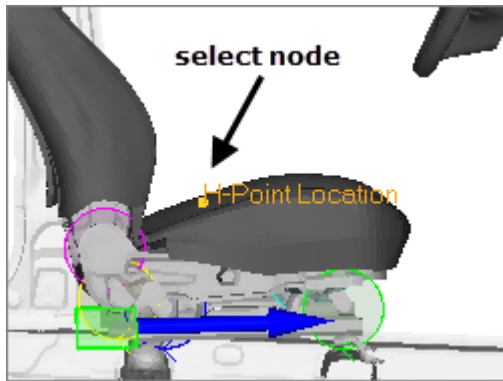
1. From the menu bar, click **Tools > Dummy** to open the **Dummy** browser.
2. In the **Dummy** browser, click on the **THOR_FE** dummy entity to activate the global positioning parameters in the **Entity Editor**.



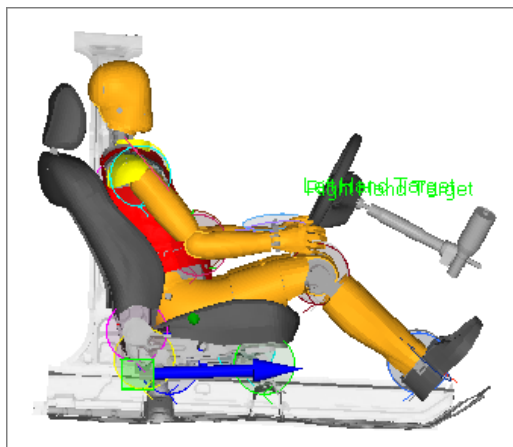
3. In the **Entity Editor**, for the **Global rotation** attribute **Rx**, enter 180. The whole dummy rotates.
4. Under **H-Point location**, click on the coordinates area and then click .



5. In the graphics area, select the node tagged as **H-Point Location** on the seat.



6. In the panel area, click **proceed**. The dummy automatically moves to the selected H-Point location.



Step 4: Manually Position the Limbs



1. In the **Dummy** browser, click the **lower_leg_left** body entity. The joint manipulator appears in the graphic area, and the **Entity Editor** opens.

Entities		ID
	hand_right	19
[-]	upper_leg_left	23
[-]	lower_leg_left	24
[-]	ankle_left	25
[-]	ankle_left2	26
[-]	upper_leg_right	8
[-]	lower_leg_right	9
[-]	ankle_right	10

Name	Value
Rotation	
Min angle	-110.0
Max angle	3.0
Current angle	-57.116636528972
Increment	
Increment	10.0

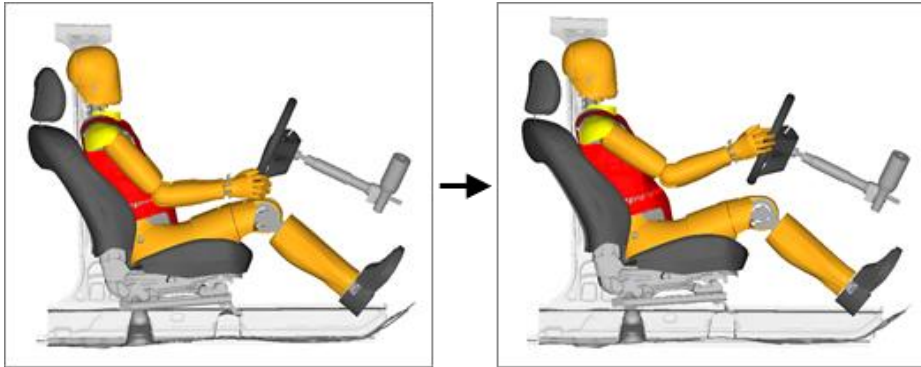
2. In the graphics area, select the smallest blue arc on the manipulator to interactively manipulate the selected body.
3. Position the lower leg in the following ways:
 - In the graphics area, select the smallest blue arc on the manipulator to interactively position the lower leg to an angle value of -70° .
 - In the **Entity Editor**, **Current angle** field, enter -70 .
4. Repeat this operation to position the **lower_leg_right** body entity.

Step 5: Automatically Position the Hands

1. In the **Dummy** browser, right-click on the **THOR_FE** dummy entity and select **Move Limbs** from the context menu.
2. In the **Entity Editor**, set **Multiple pairs** to **Yes**.
3. Click on **Select pairs** field.
4. Position the left hand.
 - a. In the **Select multi nodes** dialog, **Source Point** column, click on the first cell.
 - b. Click the **Nodes** selector.
 - c. In the panel area, click the **node** selector and enter 420848 in the **id=** field.
 - d. Click **proceed**.
 - e. In the **Select multi nodes** dialog, **Target Point** field, click the first cell.
 - f. Click .
 - g. In the graphics area, select the node tagged as **Left Hand Target**.
 - h. In the panel area, click **proceed**.
5. Position the right hand by repeating step 4.
 - a. In the **Select multi nodes** dialog, click  to add a second row to define the Source Point and Target Point for the right hand.
 - b. For **Source Point**, select the node with id=320848.
 - c. For **Target Point**, select the node tagged as **Right Hand Target**.
6. In the **Select multi nodes** dialog, click **Close**.
7. In the **Entity Editor**, click **Select Bodies**.
8. In the **Dummy Bodies DOF** dialog, enable/disable dummy bodies and body DOFs to be taken into account for the automatic positioning of the dummy limbs.
 - a. Deselect the bodies **upper_torso** and **head_neck** by clearing their corresponding checkbox in the **Body** column.

Tip: You can also deselect a body by right-clicking on the desired body in the graphics area. Activate a body or a DOF by left-clicking on the desired body or joint arrow in the graphic area.
 - b. Click **OK** to close the dialog

- In the **Entity Editor**, click **Move** to activate automatic limbs positioning.



Step 6: Save and Retrieve Dummy Positions

- In the Dummy browser, right-click on the **THOR_FE** dummy entity and select **Define Position > New** from the context menu.
- In the **Update Position info** dialog, enter `Final Position` in the **Name** field and click **Close**. The actual position of the dummy is saved and can be retrieved for future reference.
- To retrieve the initial dummy position, in the **Dummy** browser, right click on the **THOR_FE** dummy entity and select **Retrieve Position > Initial Position** from the context menu. The position of the dummy automatically moves to its initial position.
- To retrieve the saved dummy position, in the **Dummy** browser, right click on the **THOR_FE** dummy entity and select **Retrieve Position > Other Position**. In the **Positions** dialog, select **Final Position** and click **Close**.

Step 7: Link the Dummy to a Seat Mechanism

In Default you can link a dummy to a defined seat mechanism. In this way, when the seat is moved to another position, the dummy position will be automatically updated.


- Open the **Mechanism** browser, from the menu bar, by clicking **Tools > Mechanism**.
- In the **Mechanism** browser, expand the **Driver Seat** mechanism to observe the different joints and bodies defined.

Entities	ID	Type		
Driver_Seat	1			
Move_RailToFront_Lever	2	Revolute		
Move_Rail	2			
Front_Lever	4			
Move_RailToRear_Lever	3	Revolute		
Move_Rail	2			
Rear_Lever	5			
Rear_LeverToSeat_Cushion	4	Revolute		
Rear_Lever	5			
Seat_Cushion	6			
Front_LeverToSeat_Cushion	5	Revolute		
Seat_CushionToBack_Seat	6	Revolute		
Fix_RailToMove_Rail	25	Slider		


3. Right-click on the **Driver_Seat** mechanism entity and select **Link To Dummy** from the context menu.
4. In the **Dummies** dialog select **THOR_FE** and click **Next**.
5. In the **Mechanism Bodies [Master Body]** dialog, select **Seat_Cushion** and click **Next**. This body will be the master body that will drive the motion of the dummy.
6. In the **Dummy Bodies [Child Bodies]** dialog the body containing the H-Point of the dummy is automatically selected, and the Body's DOF linked with the master body are automatically set-up to TX; TY; TZ, which is sufficient. Click **Close** to finalize the linking of the dummy to the seat mechanism.

At this point, any motion of the seat will result in an according global motion of the dummy. It is also possible to constrain some bodies of the dummy that may remain in position, such as the feet.

7. Create constraints on bodies by right-clicking on the **Driver_Seat** mechanism and selecting **Create > Constraint > Point Node** from the context menu.
8. In the **Entity Editor, Body** field, click **<Unspecified> >> Body**.
9. In the **Select Body** dialog, select **ankle_left2** and click **OK**.
10. In the **Entity Editor, Point node** field, click **<Unspecified> >> Node**.
11. In the panel area, click the **node** selector and enter 681450 in the **id=** field.
12. Click **proceed**.
13. In **Entity Editor**, click the **Fixed DOF** field and select the first four checkboxes and the last checkbox. Leave the fifth checkbox cleared. Like this, the three translations and the rotations RX and RZ of the selected body are fixed in the global coordinate system. RY is free

Name	Value
Name	constraint1
ID	2
Color	
Include File	seat_kgmmms.k
Constraint type	Point node
Support	
Body	ankle_left2 (26)
Point node	Node (681450)
Fixed DOF	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/>
Fixed DOF system	<Unspecified>
Advanced	

14. Create a constraint on the **ankle_right2** body and node id=581450 with the same fixed DOF.

Name	Value
Name	constraint2
ID	3
Color	
Include File	seat_kgmmms.k
Constraint type	Point node
Support	
Body	ankle_right2 (11)
Point node	Node (581450)
Fixed DOF	1,1,1,1,0,1
Fixed DOF system	<Unspecified>
Advanced	

15. In the **Mechanism** browser, right-click on the **Fix_RailToMove_Rail** joint and select **Move** from the context menu.
16. In the **Entity Editor**, **Current Distance** field, enter -50.0 . Note how the dummy moves with the seat and how the position of the legs and feet are updated because of the constraints defined on the feet.

