



Altair

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**HyperWorks**

## HM-3680: Preserving a Shape Using Cluster Constraints

### Model Files

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This exercise uses the `truck.hm` file, which can be found in the `hm.zip` file. Copy the file(s) from this directory to your working directory.

### Exercise: Using Cluster Constraints to Preserve the Wheel Shape while Lengthening the Body of a Truck

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When circular features are stretched, they become elliptical in shape. In some cases as in the wheels of a truck, this effect is not desirable. In such cases, using cluster constraints will allow you to translate the features, along with the morph, while maintaining its circular shape.

In the exercise you will be changing the length of the cab while preserving the shape of the wheel. To facilitate the morphing process you will be employing constraint and symmetry.

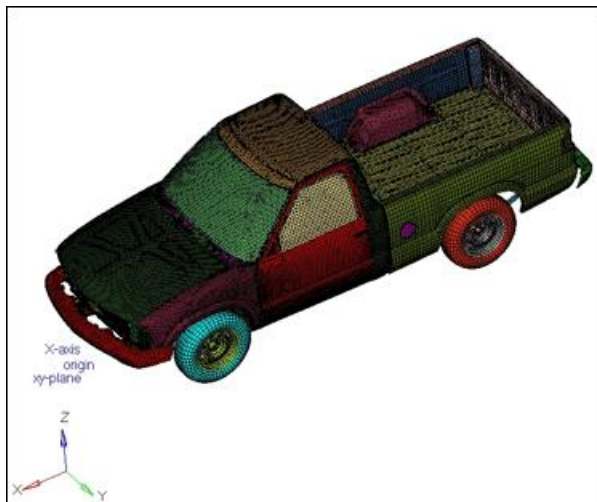


Figure 1: Truck model

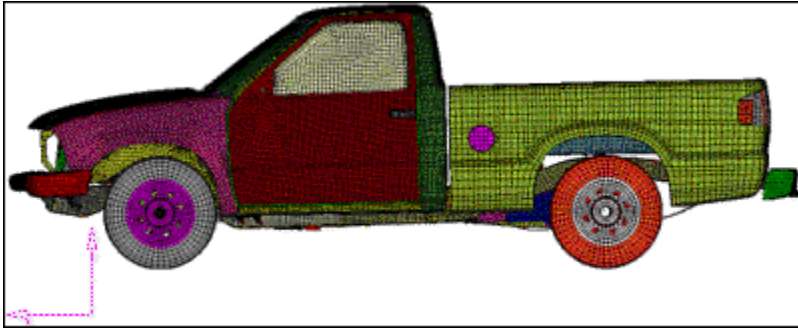
#### Step 1: Load and review the model.

Open the HyperMesh file `truck.hm`.

#### Step 2: Create a coordinate system.

1. Using the menu bar select **Geometry > Create > Systems > Axis Direction**.
2. For **origin** select the node with tag **origin**.
3. For **x-axis**, select node with tag **x-axis**.
4. For **xy-plane**, select node with **xy-plane**.
5. Click **create** to create the coordinate system.

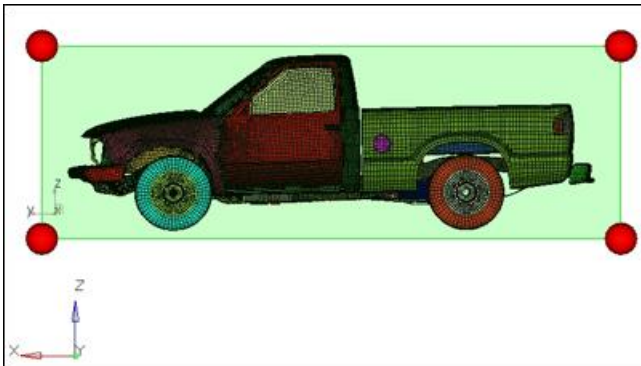
- On the toolbar, select **XZ Right Plane View** (  )



- Click **return** to exit the panel.

### Step 3: Create and split the morph volume.

- From the menu bar select **Morphing > Create > Morph Volumes**.
- Switch the creation method to **create morphvol**.
- Set entity type to **enclose elements**.
- Select **elems >> all**.
- Set system to **global system**.
- Set **buffer %** = 5.  
The morph volume is created.
- Click **create** to create the morph volume.



- Click the **split/combine** subpanel.
- Toggle the operation to **split mvols**.
- Toggle to split the morph volume **by edges**.
- Toggle the type of split to **single split**.
- Set **single split** = 0.44.
- Select the **morph volume** in the graphics window.

14. Click **split** to split the morph volume.

The original morph volume is now split into two morph volumes.

15. Click **return** to exit the panel.

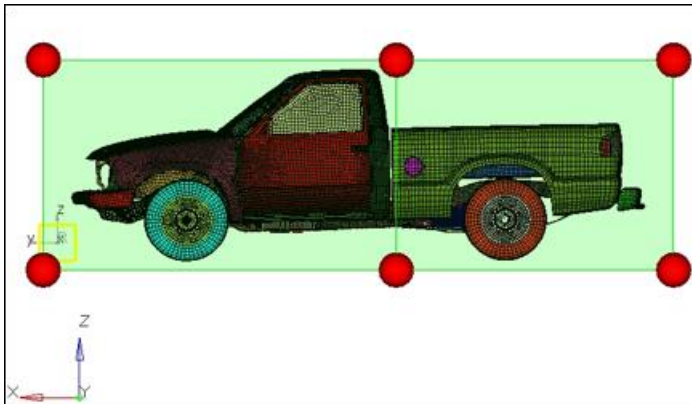
#### Step 4: Create a Symmetry.

1. From the menu bar select **Morphing > Create > Symmetries:**
2. For **name =**, enter `symm1`.
3. Under **domain**, check the box for **morph volumes**.

Symmetry can be linked to either domains or morph volumes. In this exercise since you are dealing with morph volumes you will use the check to link the **symmetry** to the **morph volume**.

4. Switch the symmetry type to **1 plane**.
5. For **syst**, select the coordinate system created in step 4.2.
6. Click **create** to create the symmetry.

A **1 plane** symmetry with a square symbol has been created.



7. Click **return** to exit the panel.

#### Step 5: Morph the part.

1. From the menu bar select **Morphing > Morph**, then click the **move handles** subpanel.
2. Switch the morphing mode to **translate**.
3. Switch the along option to **along xyz**.
4. Set the following values:
  - **X val** = 500
  - **Y val** = 0
  - **Z val** = 0

5. Select two **handles** as shown in figure 3.
6. Click **morph** to morph the front half of the truck.

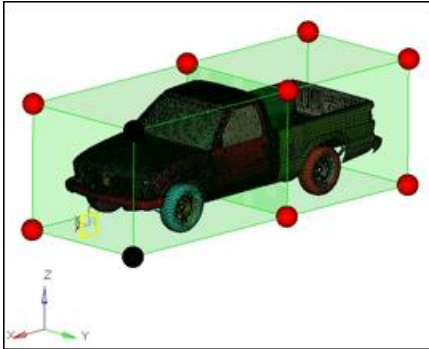


Figure 2.1 Front half of the truck to morph

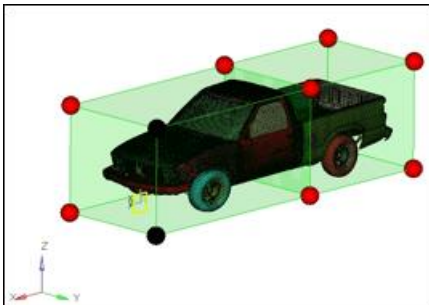


Figure 2.2 Front half of the truck morphed

The front end is stretched 500 units. Since the front wheels are also the part of the morph volumes they became elliptical after morphing. This is not desirable. You will undo this morphing, constrain the wheels and re-do it.

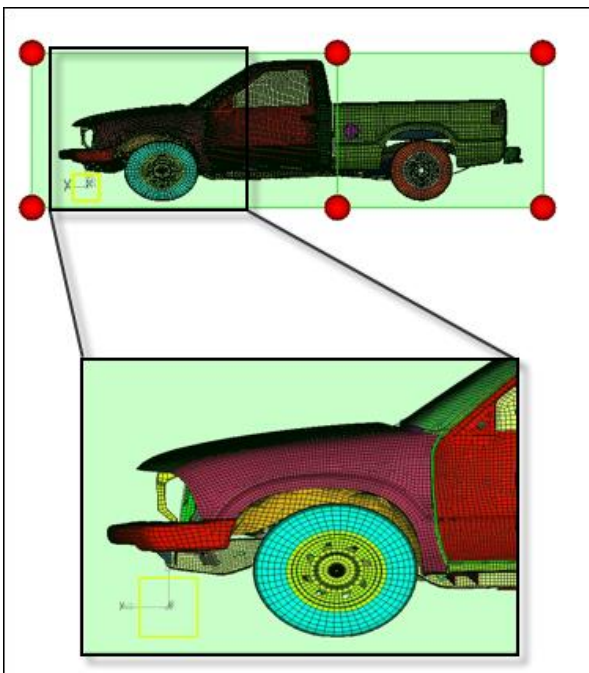


Figure 3: undesired morphing of the front wheel

7. **Undo all** morphs.

### Step 6: Create a cluster constraint.

As seen in the previous image, the front wheels, after morphing, become elliptical. To fix this issue, you will be employing a particular type of constraint, called a **cluster** constraint, which helps to keep the original shape of a portion of the model while morphing.

1. From the menu bar select **Morphing > Create > Morph Constraints**.
2. Set **name** = const2.
3. Switch the constraint type to **cluster**.
4. Select **nodes >> by collector** .
5. Select **comps >> by id**.
6. Use **id** = 1-8 and then hit ENTER on the keyboard.
7. Click **select** to select the components.
8. Click **create** to create the cluster constraint.

The cluster constraints are created on the nodes of the selected components.

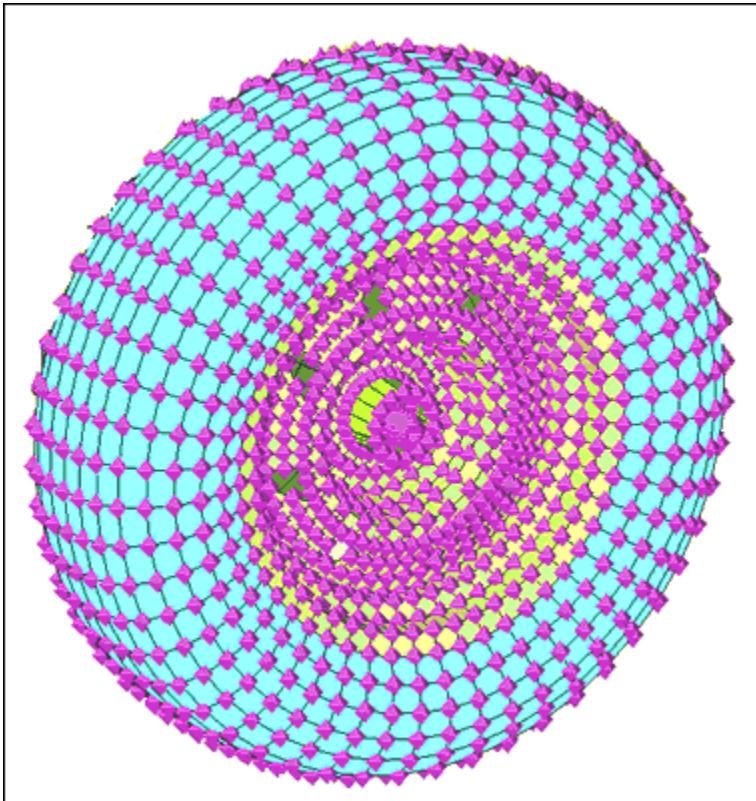


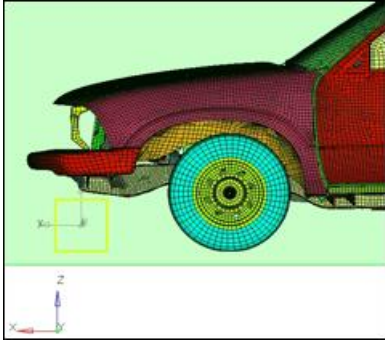
Figure 4

9. Click **return** to exit the panel.
10. In the **Model Browser**, right-click **MorphingConstraint** and click **Hide** to turn off the constraints.

**Step 7: Morph the part.**

Repeat the procedure in Step 5 to morph the front of the truck by 500 units.

The front end is stretched 500 mm. The front wheels are moved in the morphing process while maintaining their circular shape.

**Summary**

Using cluster constraints and morph volumes you are able to stretch the cab of the pickup without distorting the wheels.