Altair

HyperWorks

HM-3660: Maintaining Area Using Constraints

Model Files

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

Exercise: Using Morph Constraints to Keep the Area of a Windshield Constant while Changing its Shape

In this exercise will change the shape of the windshield while keeping its area constant.
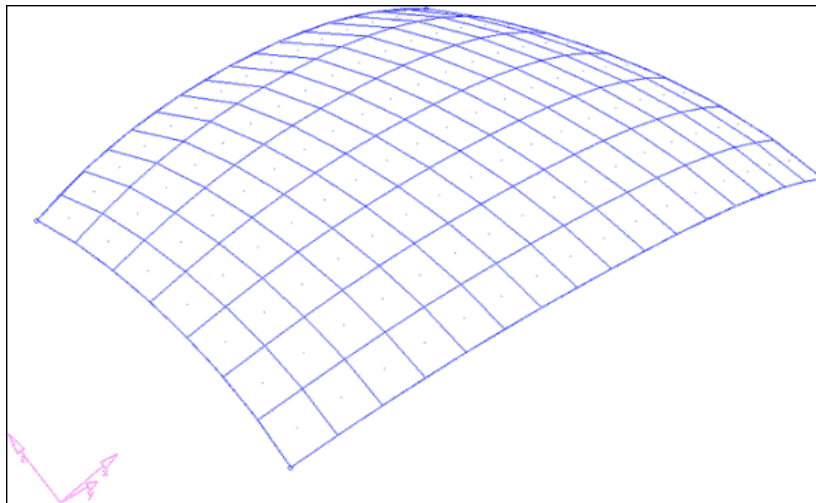

Figure 1: Windshield mesh

Step 1: Load and review the model.

Open the HyperMesh file `windshield.hm`.

Step 2: Create a shape to define the degree of freedom for the mesh.

1. From the menu bar select *Morphing* > *Free Hand* and select the **move nodes** subpanel.

2. Switch the method to *translate*.

3. Key in

    •   **x =** 0;

    •   **Y =** -5 (negative 5);

    •   **Z =** 0

4. Under **moving nodes:** click *nodes >> by sets* and select *move_node*.

5. Click *select*.

6. Under **fixed nodes:** click *nodes >> by sets* and select *fix_node*.

7. Click *select*.

8. Under **affected elements:** click *elems >> displayed*.

9. Click *morph*.

10. Go to the *save shape* subpanel.

11. For **name =**, enter Shape1.

12. Toggle the save option to *as node perturbations*.

13. Click *save*.

14. Click *undo all* to bring the model to its original position before morphing.

This initial shape defines the direction in which the nodes have the freedom to move, as the shape of the windshield is changing, thus enabling us to keep the area at a constant.

Step 3: Create a constraint.

1. From the menu bar select *Morphing* > *Create* > *Morph Constraints*.

2. Set *name =* const1.

3. Change the constraint type to *area*.

4. For *shapes*, select Shape1.

5. Select *elems >> displayed*.

6. Switch the **area** option to *equal to*.

7. Click *calculate* to calculate the area of the mesh:

   Note: The value shows in the area box is: **1.085e+06**.

   This is the actual surface area of the windshield which will be maintained.

8. Click *create*.
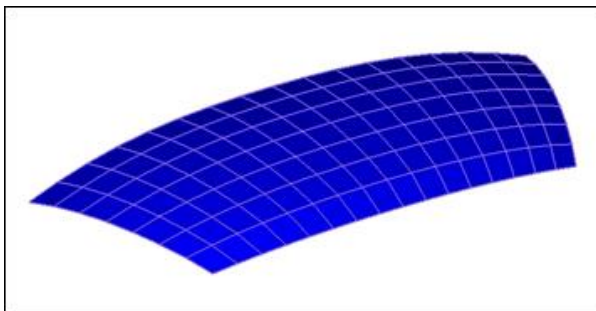
   Note: The constraint is created. The symbol for the constraint is a matching-mesh.

9. Right-click *Shape* and select *Hide* in the **Model Browser**.

10. Right-click *MorphingConstraint* and select *Hide* in the **Model Browser**.

Step 4: Create morph volume.

1.   From the menu bar select ***Morphing*** > ***Create*** > ***Morph Volumes***.

2.   Switch the method to ***create morphvol***.

3.   Toggle entity type to ***enclose elems***.

4.   Select ***elems >> displayed***.

5.   Toggle coordinate system to ***global system***.

6.   Click ***create***.

     The morph volume is created.

Step 5: Morph the part.

1.   From the menu bar select ***Morphing*** > ***Morph*** and select the **move handles** subpanel.

2.   Change the morph type to ***move to node***.

3.   For **from: handle**, select handle1 (Figure 2).

4.   For **from: node**, select node1 (Figure 2).

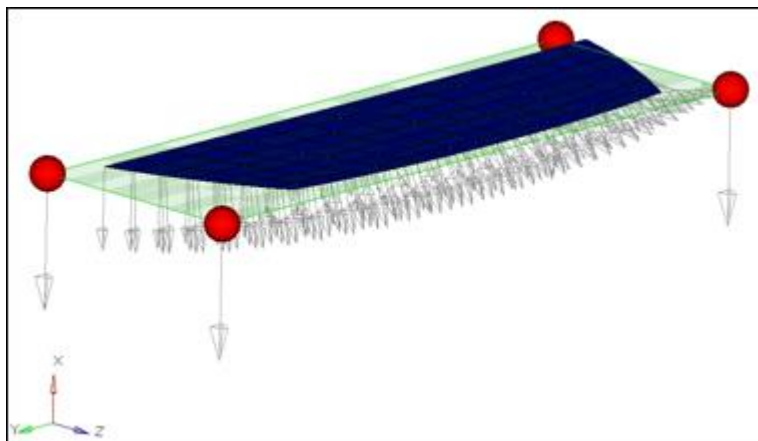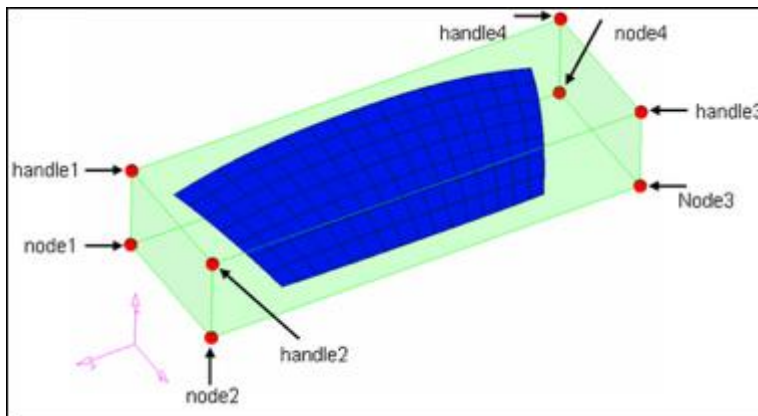5.   Repeat the process for the other handles and nodes.

Figure 2: **From handles** and **from nodes**

Step 6: Save the morphed shape.

1. Click the *save shape* radio button.

2. Set **name =** `Shape2`.

3. Toggle the save option to *as node perturbations*.

4. Click *save*.

Step 7: Check the result.

1. Right-click *MorphingVolume* in the **Model Browser** and select *Hide*.

2. Go to *View > Toolbars*, make active *Checks* toolbar , select the *Mass/Area Calc* ( ) icon.

3. For **comps**, select *windshield*.

4. Click *select*.

5. Click *calculate*.

    The final area of the windshield is **1.085e+06**, which is the same as the initial area. So, even though the profile of the windshield has changed, its area has not. As the height of the windshield reduced, it expanded in the direction provided by `Shape1`.

Summary

Using morph constraints, you able to change the shape of the windshield, while keeping its area constant.