



Altair

HyperWorks

HM-4430: Defining ANSYS Contacts for 3-D Models in HyperMesh

Before you begin this tutorial, it is recommended that you complete [HM-1000: Getting Started with HyperMesh](#) and [Exploring the ANSYS Interface](#).

In this tutorial you will learn how to set up surface to surface contacts. In HyperMesh, you can create contact pairs manually or with the Autocontact tool. In this exercise you will learn how to set up contacts manually.

The steps mentioned in this tutorial are only applicable for HyperMesh 14.0.130 and on.

Model Files


This exercise uses the `hm-ansys_contact_manager_3-d_tutorial.hm` file, which can be found in `<hm.zip>/interfaces/ansys/`. Copy the file(s) from this directory to your working directory.

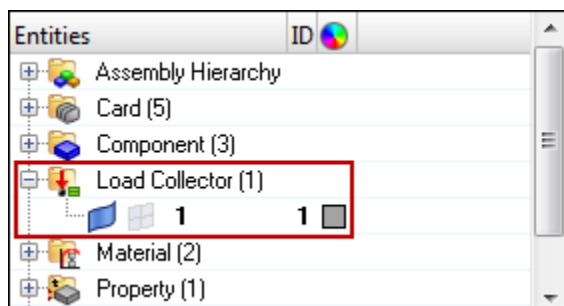
Exercise

Step 1: Load the ANSYS User Profile

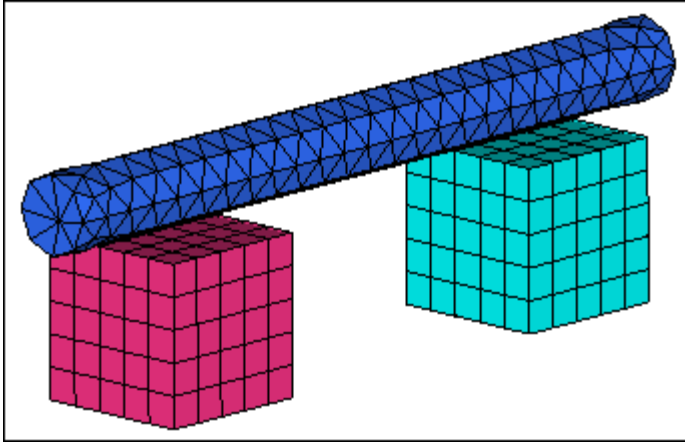
1. Start HyperMesh Desktop.
2. In the **User Profile** dialog, set the user profile to **Ansys**.

Step 2: Retrieve the HyperMesh Model File

1. From the menu bar, click **File > Open > Model**.
2. In the **Open Model** dialog, open the `hm-ansys_contact_manager_3-d_tutorial.hm` file. A model loads in the graphics area.
3. If the load collector is displayed, in the **Model** browser, click  next to the load collector to turn off the display of its elements.

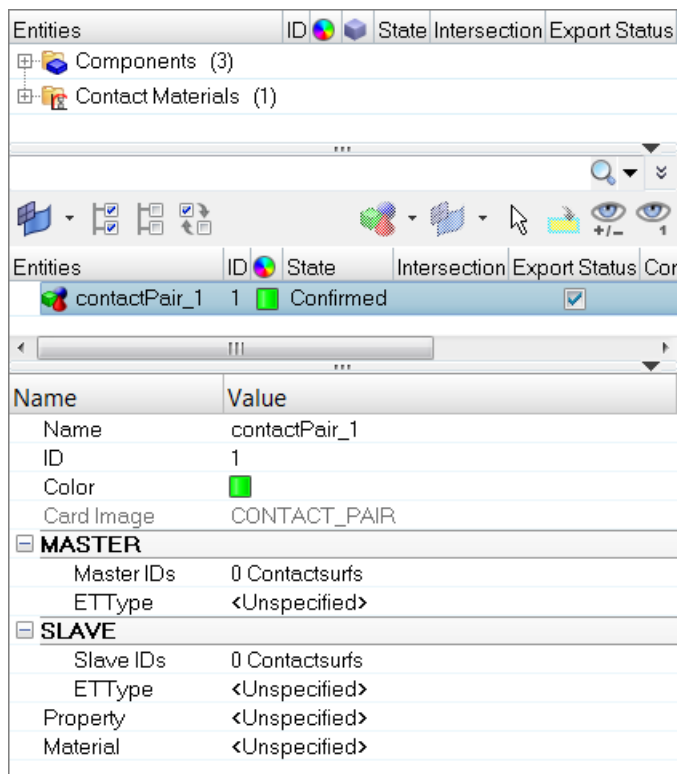


4. In the graphics area, click once to make it the current window for keyboard commands.
5. Fit the model to the graphics area by pressing **f**.



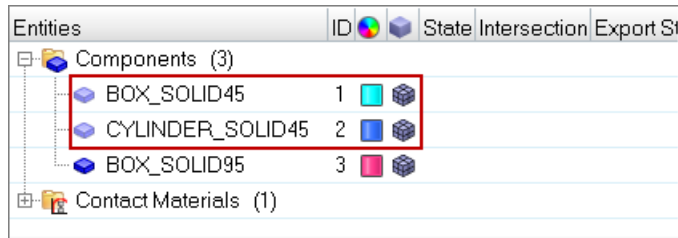
Step 3: Create a Contact Pair

1. Open the **Contact** browser from the menu bar by clicking **View > Browsers > HyperMesh > Contact**.
2. In the second pane of the **Contact** browser, right-click and select **Create > Contact Pair** from the context menu. HyperMesh creates and opens a contact pair in the **Entity Editor**.

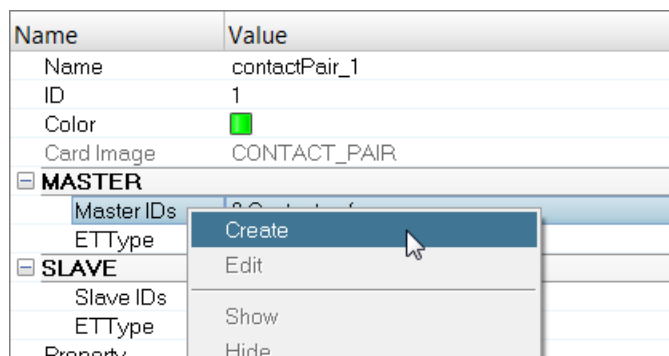


Step 4: Create and Attach a Contact (Master) Surface

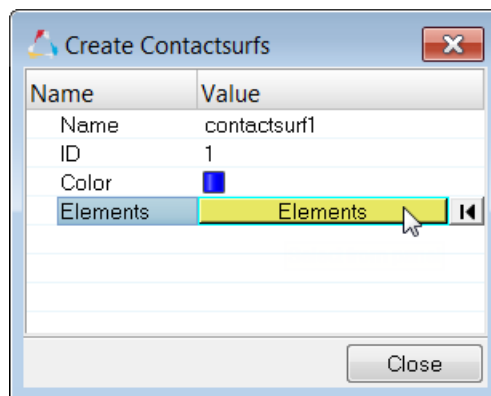
1. Mask the **BOX_SOLID45** and **CYLINDER_SOLID45** components.



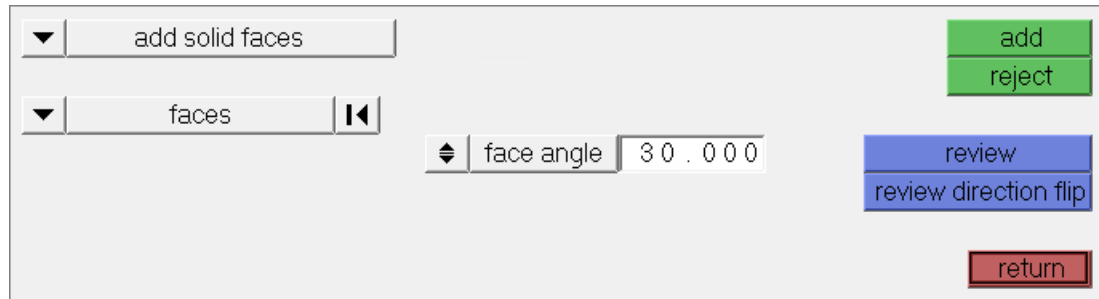
2. In the second pane of the **Contact** browser, select **contactPair_1**.
3. Create and attach a contact (master) surface.
 - a. In the **Entity Editor**, right-click on **Master IDs** and select **Create** from the context menu.



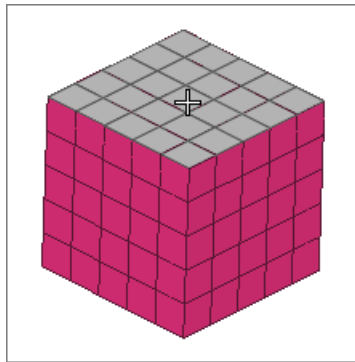
- b. In the **Create Contactsurfs** dialog, for **Elements**, click **0 Elements >> Elements**.



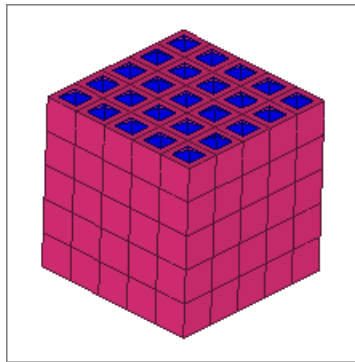
- c. In the panel area, set the first switch to **add solid faces**.
- d. Set the advanced selection switch to **faces**.




- e. Select the top faces of the cube as indicated in the image below.



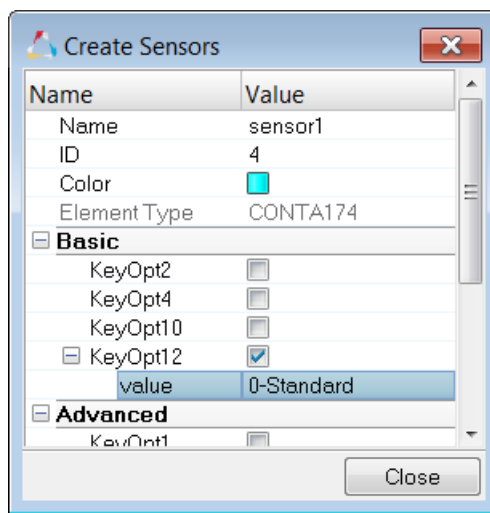
- f. Click **add**.
- g. Observe the newly created contact surfaces. The normals of the surface are pointing outwards. By default, when contact surfaces are created over solid element faces, normals point outwards.



- h. In the panel area, click **return**.
- i. In the **Create Contactsurfs** dialog, click **Close**.
4. Create and attach an Et Type to the contact surface.
- a. In the **Entity Editor**, under **MASTER**, right-click on **ETType** and select **Create** from the context menu.

Name	Value
Name	contactPair_1
ID	1
Color	
Card Image	CONTACT_PAIR
MASTER	
Master IDs	1 Contactsurfs
EType	
SLAVE	
Slave IDs	
EType	
Property	


- b. In the **Create Sensors** dialog, the **Element Type** is set to **CONTA174**.
- c. Enable **KeyOpt12**, then select **0-Standard** from the list.

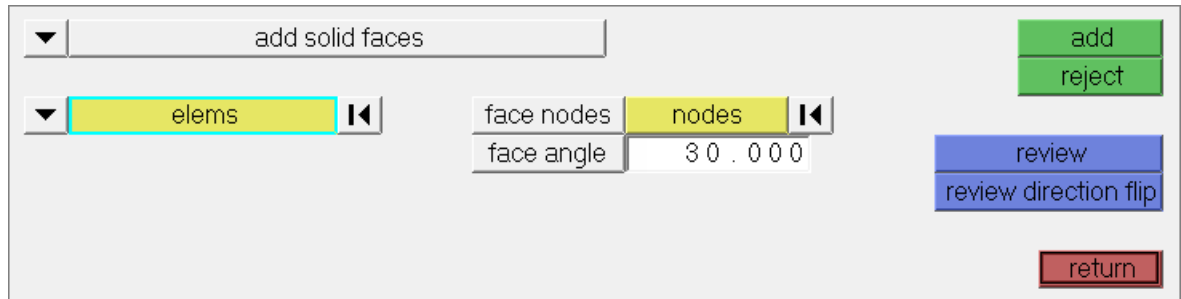


- d. Close the dialog.

Step 5: Create and Attach a Target (Slave) Surface

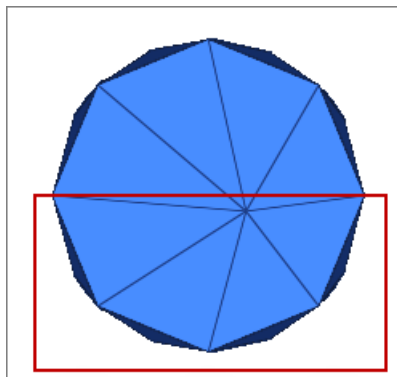
The bottom half of the CYLINDER_SOLID45 component will be used as the target surface.

1. Unmask the **CYLINDER_SOLID45** component, and mask the **BOX_SOLID45** and **BOX_SOLID95** components.
2. On the **Standard Views** toolbar, click  to orient the model to the XY top plane view.
3. Create and attach a target (slave) surface.
 - a. In the **Entity Editor**, right-click on **Slave IDs** and select **Create** from the context menu.
 - b. In the **Create Contactsurfs** dialog, for **Elements**, click **0 Elements >> Elements**.
 - a. In the panel area, set the first switch to **add solid faces**.
 - b. Set the advanced selection switch to **elems**.

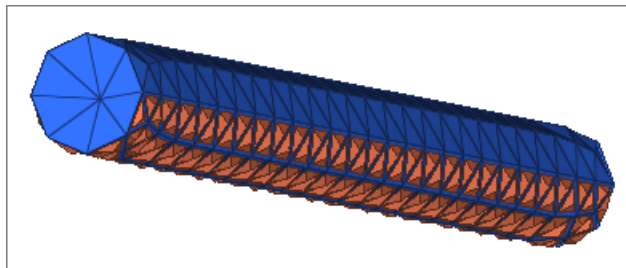


- c. Select the elements indicated in the image below.

Tip: Quickly select elements with window selection by pressing **SHIFT** while clicking and dragging your mouse.




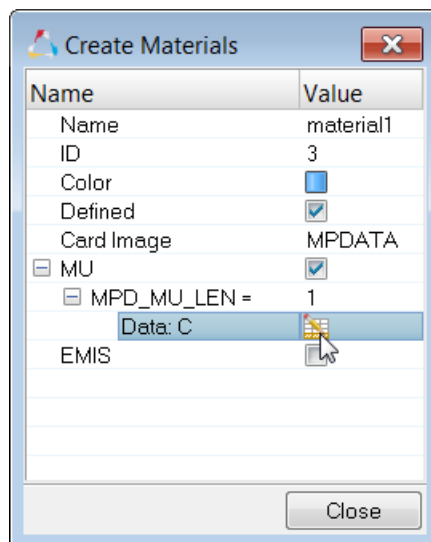
- d. Using the **nodes** selector, select face nodes on the selected elements.
 e. Click **add**. Surfaces are created on selected elements.



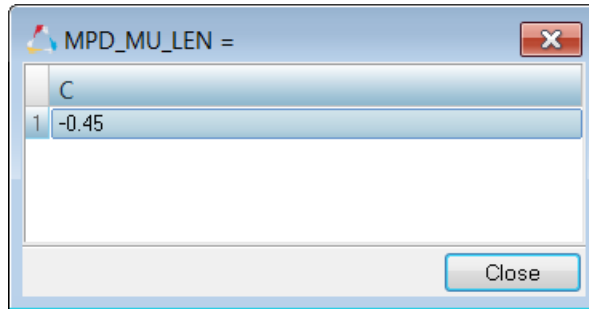
- f. In the panel area, click **return**.
 g. In the **Create Contactsurfs** dialog, click **Close**.
3. Create and attach an Et Type to the contact surface.
- In the **Entity Editor**, under **SLAVE**, right-click on **ETType** and select **Create** from the context menu.
 - In the **Create Sensors** dialog, the **Element Type** is set to **TARGE170**.
 - Enable **KeyOpt4**, then select **0-All DOF are constrained** from the list.
 - Close the dialog.

Step 6: Create and Attach a Property and Material to the Contact Pair

1. Create and attach a contact property.
 - a. In the **Entity Editor**, right-click on **Property** and select **Create** from the context menu.
 - b. In the **Create Properties** dialog, define the property and click **Close**.
 - Set **FKN** to 1.0.
 - Set **FTOLN** to 0.1.
 - Set **TAUMAX** to 1e20.
 - Set **FKOP** to 1.0.
 - Set **FKT** to 1.0.
 - Set **FHTG** to 1.0.
 - Set **RDVF** to 1.0.
 - Set **FWGT** to 0.5.
 - Set **FACT** to 1.0.
2. Create and attach a contact material.
 - a. In the **Entity Editor**, right-click on **Material** and select **Create** from the context menu.
 - b. In the **Create Materials** dialog, define the material and click **Close**.
 - Set **Card Image** to **MPDATA**.
 - Select the **MU** (coefficient of friction) checkbox.
 - For **MP_MU_LEN**, enter 1.
 - Under **MP_MU_LEN=**, next to **Data: C**, click .

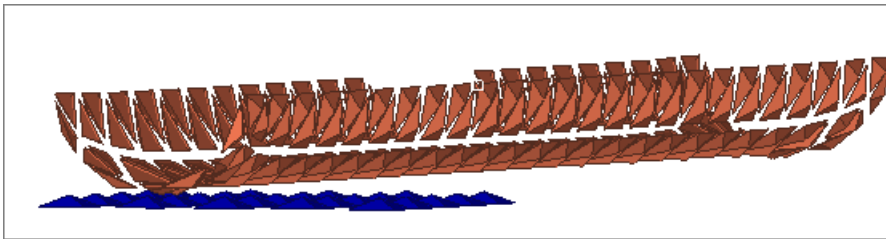


- In the **MP_MU_LEN=** dialog, enter -0.45 and click **Close**.

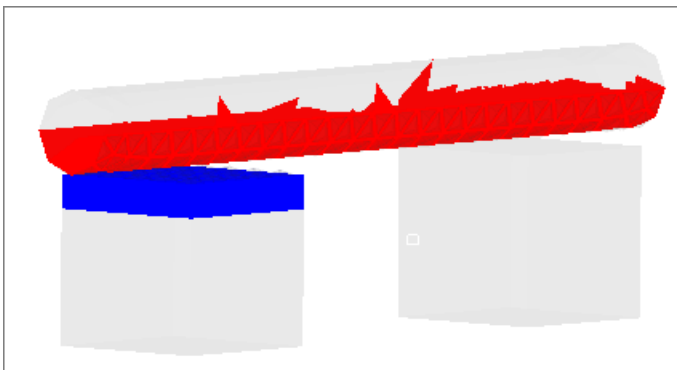


Step 7: Review the Contact Pair

1. In the browser, unmask all of the components and contact surfaces.
2. In the second pane of the browser, right-click on **contactPair_1** and select **Isolate Only** from the context menu. Only the master and slave surfaces display.



3. Check the normals of the surfaces. Notice how the surfaces are pointing out. If the normals are facing each other then it is a valid direction. In this tutorial, the normals should be pointing each other.
4. When you are done reviewing, turn the display of all entities back on.
5. Right-click on **contactPair_1** and select **Review** from the context menu. Contact regions display.



6. When you are done reviewing, right-click on **contactPair_1** and select **Reset Review** from the context menu.

Step 8 (Optional): Add /SOLU and SOLVE in the Control Cards

If your model needs to be solved in ANSYS, add the following control cards.

1. Open the **Control Cards** panel by clicking **Setup > Create > Control Cards** from the menu bar.
2. Click **/SOLU** to exit the **PREP7 preprocessor** and enter the **SOLU preprocessor**.

AUTOTS	ETABLE	OUTRES	MODOPT	LUMPM
/BATCH	KBC	/POST1	MXPAND	ACEL
BFUNIF	LNSRCH	PRESOL	EQSLV	CGLOC
/COM	MODE	RSYS	ALPHAD	CGOMGA
CNVTOL	NEQIT	/SOLU	BETAD	CMDOMEGA
DELTIM	NLGEOM	SOLU	PSTRES	CMOMEGA
DOF	NSUBST	ANTYPE	EXPASS	DCGOMG

→

```
! Exit PREP7 processor
FINISH
! Enter SOLU processor
/SOLU
```

3. Click **return**.
4. Click **SOLVE**.

Note: If you do not see the **SOLVE** control card, click **next**.

SUBOPT	SOLVE	UNSU_PREP_END
EMUNIT	LSSOLVE	
EORIENT	STEF	
UNSU_PREP7	HEMIOPT	
UNSU_END	RADOPT	
/UNITS	SPCTEMP	
NUMOFF	UNSU_PREP_MID	

→

```
SOLVE

User Comments
▼ Hide In Menu/Export
```

5. Click **return** to exit the card image.
6. Click **return** to exit the **Control Cards** panel.