Collision Detection Tool

Use the Collision Detection tool to check components or groups for element penetrations and intersections. Penetration and intersection can be used individually or collectively. Penetration is defined as the overlap of the material thickness of shell elements, while intersection is defined as elements passing completely through one another.

To invoke the Collision Detection tool, click Tools > Collision Detection from the menu bar.

The Collision Detection tool is only available in the RADIOSS and LS-DYNA user profiles.

Checking, Reviewing, and Fixing

- Penetrations/Intersections
  1. Setup the collision detection and check for intersections/penetrations.

  a. In the Collision browser, click to invoke the collision setup widget.
  b. In the Check type field, select the type of collision to check.
     • Intersections
     • Penetrations
     • Intersections and Penetrations
  c. In the Entity type field, select the type of entity to be checked for intersections and/or penetrations.
  d. In the Selection field, select contacts(groups) or components to check.

Selecting one of more contacts will perform the penetration check according to the rules enforced by the solver. In any case, the penetrating elements will be found, and the results will display in the penetration browser. Results will be listed by pairs of components regardless of the entity type that was used to select penetration candidates.

e. Select a Thickness option.
   Component thickness applies no adjustments as it uses the thickness value specified in a component’s property card for each element within that component.
   Thickness multiplier multiplies the selected entities’ thickness by the value entered in the Thickness multiplier field for purposes of the penetration check. Fractional values are acceptable, but negative values are not.
   Uniform thickness ignores the existing component's thickness, and instead uses the value entered in the Uniform Thickness field for all of the components in the model.

   Use Uniform thickness as a workaround to the lack of thickness information in the default HyperMesh user profile, or when working with models that do not have a thickness specified.

f. Select a Thickness > size option.
   • Full thickness, but ignore neighborhood (slow, but accurate if thickness > element size)
   • Reduce thickness to 40% of elem size (fast)
   • Full thickness, consider neighborhood (special usage only)

To consider edge penetrations, select the Consider edge penetrations checkbox. Click Check. Once the check is complete, the browser populates with detected intersections and/or penetrations.
2. Review the penetrations/intersections using the view controls in the browser.

3. Fix the penetrations/intersections.
   a. Manually fix.
      i. Select groups/components to fix in the browser.
      ii. Click on the collision toolbar. Additional tools display.
      iii. Select the elements or nodes to move.
      iv. Move and/or translate the selected elements/nodes.
      v. Click to recheck that the intersection/penetration no longer remains.
   b. Automatically fix.
      i. Select groups/components to fix in the browser.
      ii. Click on the collision toolbar.

Tips:
   If a component is intersecting with another, right-click on the component and select **Find Matching Penetrating Component Pair** from the context menu to find the same pair of components in the penetrations list. If the pair does not penetrate, a message will display.
To keep a specific component from changing when performing de-penetration fixes, right-click on that component and select **Lock Component** from the context menu. A red padlock displays on the component name in the browser to indicate that it has been locked. The nodes in a locked component cannot be moved by the Collision tool. To unlock, right-click a locked component and select **Unlock Component** from the context menu.

• Sort the columns in the browser by clicking the column headings. For example, clicking the **Violations** heading sorts the parent components according to their number of violations. A small triangular arrow in the column heading indicates whether the components are sorted in ascending or descending order; repeated clicks toggle between these two options.

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**Collision Detection Browser Options**

**Collision Toolbar**

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Invoke Collision Setup" /></td>
<td>Invokes the collision setup widget, which can be used to setup the collision detection and check for intersections/penetrations.</td>
</tr>
<tr>
<td><img src="image" alt="Rerun Collision Check" /></td>
<td>Reruns the collision check. This is recommended when you modify any attributes that control the collision check, or when a mesh modification has occurred.</td>
</tr>
<tr>
<td><img src="image" alt="Automatically Fix Selected Intersections/Penetrations" /></td>
<td>Automatically attempts to fix the intersections/penetrations you have selected in the browser, based on the settings found in the Options dialog. You can perform a fix on all of the intersections/penetrations listed in the browser, but it is highly recommended that all intersections are resolved before any automatic penetration fix is executed.</td>
</tr>
<tr>
<td><img src="image" alt="Manually Fix Intersections/Penetrations" /></td>
<td>Enables you to manually fix intersections/penetrations. When selected, additional tools display in the browser that can be used to perform manual, rather than automatic, penetration fixes.</td>
</tr>
<tr>
<td><img src="image" alt="Export Collision Results" /></td>
<td>Exports the result of the collision run to a .txt or .csv file. Nodes and nodes + element pairs are supported.</td>
</tr>
</tbody>
</table>
When multiple collisions are displayed in graphics area, click this button to identify the collision pairs in the collision browser after making a selection in the graphics area.

Displays a node List for selected penetration that reports penetration depth (thickness minus residual distance), thickness, relative penetration, (penetration divided by thickness) and residual distance for all penetrating nodes.

**View Controls**

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Highlight" /></td>
<td>Highlights all elements that caused penetrations or intersections when you select a component in the browser.</td>
</tr>
<tr>
<td><img src="image2.png" alt="Transparent" /></td>
<td>Makes all elements transparent (wireframe) except for the interacting elements of the component that you selected in the browser, which display in a solid color.</td>
</tr>
<tr>
<td><img src="image3.png" alt="Color Gradient" /></td>
<td>Displays a color gradient of the penetrating elements in the selected component, which indicates the severity (degree) of penetration for the interacting elements. This mode is not available for intersections because their depth cannot be determined.</td>
</tr>
<tr>
<td><img src="image4.png" alt="Color Gradient" /></td>
<td>Displays a color gradient of relative penetrating elements.</td>
</tr>
<tr>
<td><img src="image5.png" alt="Vectors" /></td>
<td>Displays individual vectors for each penetrating element in the component that you select in the browser. These vectors indicate the direction and depth of penetration for both the selected component and its interacting components. This mode is not available for intersections because their depth cannot be determined.</td>
</tr>
<tr>
<td><img src="image6.png" alt="Fit" /></td>
<td>Fits the failed elements to the display. In large models, this can be very helpful in finding and viewing small areas of minor penetration. Note that while this option is active, the view automatically fits to the penetrating elements of any component that you click in the browser. Click the option again to deactivate the fit mode.</td>
</tr>
<tr>
<td><img src="image7.png" alt="Unmask" /></td>
<td>Displays all elements, by unmasking all elements in the model (but not other masked entities such as model geometry).</td>
</tr>
<tr>
<td><img src="image8.png" alt="Mask" /></td>
<td>Masks everything in the model except for components with penetrations or intersections. Note that this option only applies to components for which you have run the current penetration check; other components may be interacting, but if you...</td>
</tr>
</tbody>
</table>
have not run a check on them they do not appear as interacting, and they will be masked.

Masks everything in the model (including the interacting components), except for the specific elements that penetrate or intersect.

### Manual Fix Tools

<table>
<thead>
<tr>
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</tr>
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<tbody>
<tr>
<td><img src="image" alt="Select Elements By Tree" /></td>
<td>Select Elements By Tree. When enabled, clicking the lowest-level component in the browser selects all of its failed elements.</td>
</tr>
<tr>
<td><img src="image" alt="Select Elements Manually" /></td>
<td>Select Elements Manually. When enabled, you can click each desired element belonging to the lowest-level component in the browser. This includes the ability to select non-failed elements or a sub-set of the failed elements.</td>
</tr>
<tr>
<td><img src="image" alt="Select Nodes By Tree" /></td>
<td>Select Nodes By Tree. When enabled, clicking the lowest-level component in the browser selects all of the penetrating nodes in its failed elements. This differs from Select Elements By Tree in that individual nodes can be moved to fix a penetration (thus changing the shape of a failed element) instead of moving entire elements.</td>
</tr>
<tr>
<td><img src="image" alt="Select Nodes Manually" /></td>
<td>Select Nodes Manually. When enabled, you can click each desired node belonging to the lowest-level component in the browser. This includes the ability to select individual nodes of non-failed elements, or a sub-set of nodes belonging to the failed elements.</td>
</tr>
</tbody>
</table>
| ![Arrow](image) | Determines the direction that you wish to manually move the selected nodes or elements. Click the small triangle, in the bottom corner, to select one of the following:  
• move along the average normal of the selected elements (or related elements in the case of selected nodes).  
• move along a fixed vector.  
• move along the X axis.  
• move along the Y axis.  
• move along the Z axis.  
• move along an already-existing vector entity in your model that you select.  
• move along nodes in your model that you select to define the direction vector. If you pick two nodes, they define the direction. If you pick three nodes, the direction is the normal of the plane that these three nodes define (picking more than three nodes uses only the last three picked.). |
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<tr>
<td>🔖</td>
<td>Moves the selected nodes/elements by the negative amount specified in the numeric text box.</td>
</tr>
<tr>
<td>🔘</td>
<td>Moves the selected nodes/elements by the positive amount specified in the numeric text box.</td>
</tr>
</tbody>
</table>