Altair HyperWorks™

2022

Point Realization Methods

Overview of the point connector realization process and methods.

The following flow chart outlines a four-stage process used to select the best routine for point realizations.

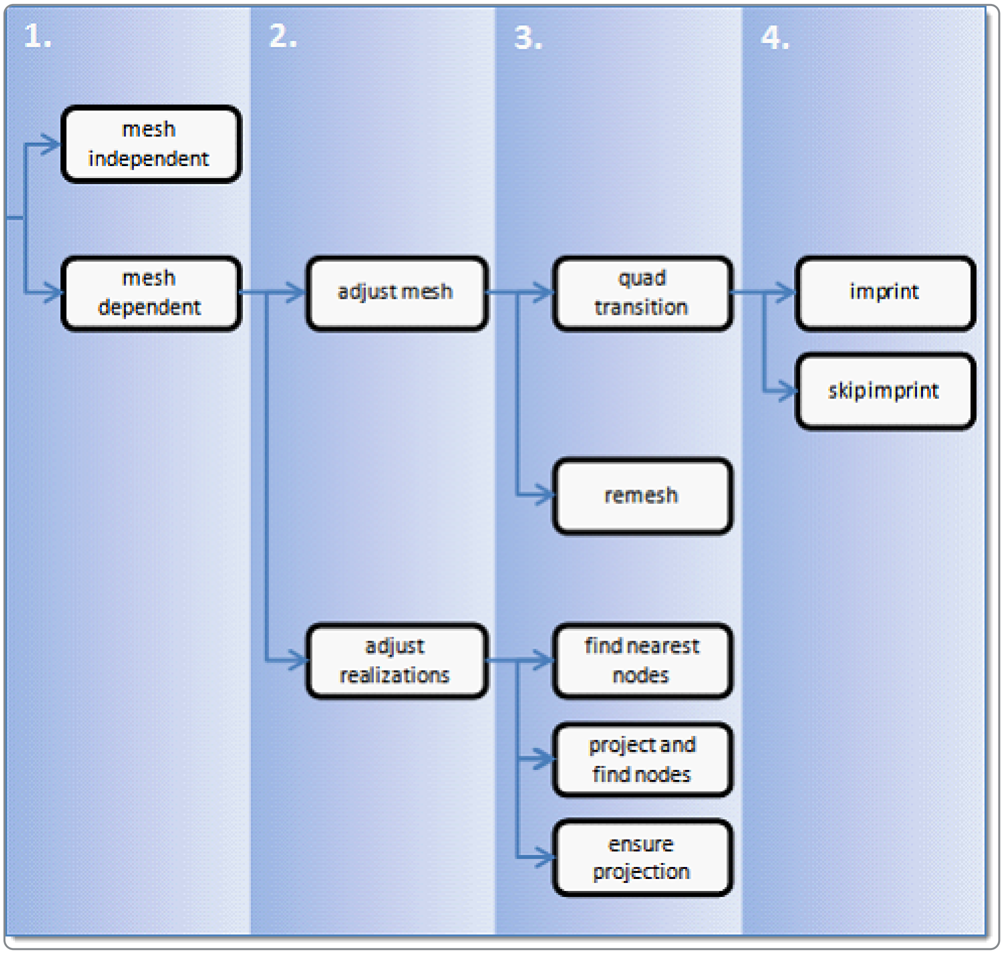


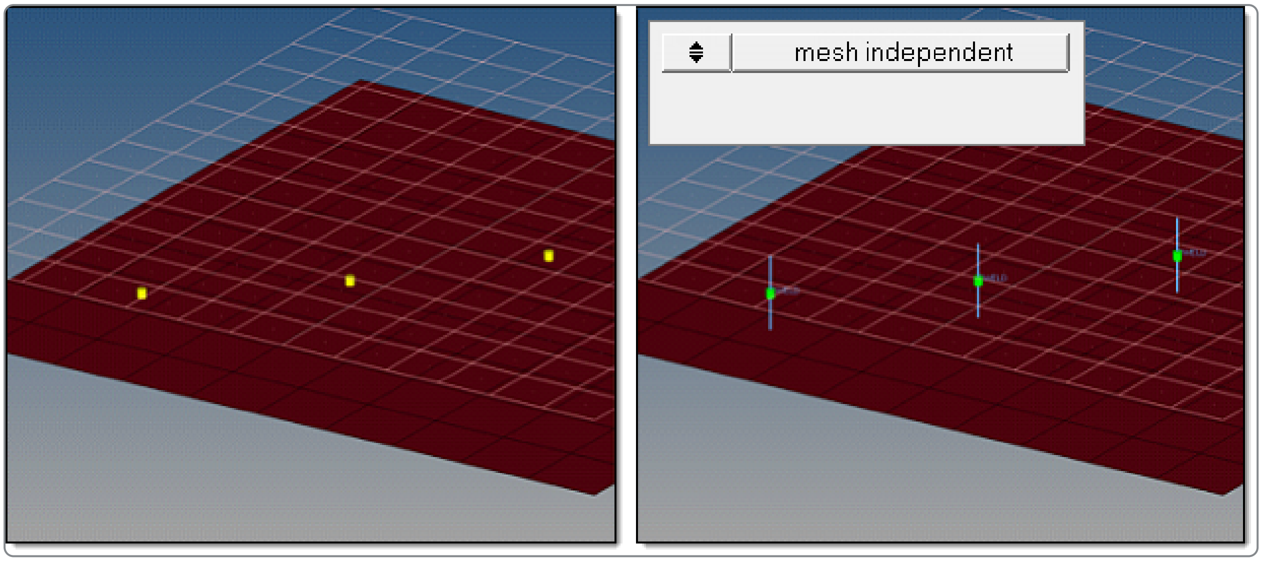
Figure 1.

1. Under the Connectivity heading, select the realization type.

   mesh independent

   Use for realizations that do not need mesh changes for the body of the realization, and the connection is primarily defined via a solver-specific card or 0D elements, such as CWELDs for Nastran or ACM for OptiStruct.

   During the realization, the solver-specific connection is created. For example, for the Nastran CWELD of ELEMID option, the shells which are in contact are observed and defined in the CWELD card.

   mesh dependent

   Use for all other cases.

2. If **mesh dependent** is selected, you must decided whether to adjust the mesh or the realization.

   adjust mesh

   Projection is done in a perpendicular way, and the mesh must be adapted to the projection points.

   adjust realizations

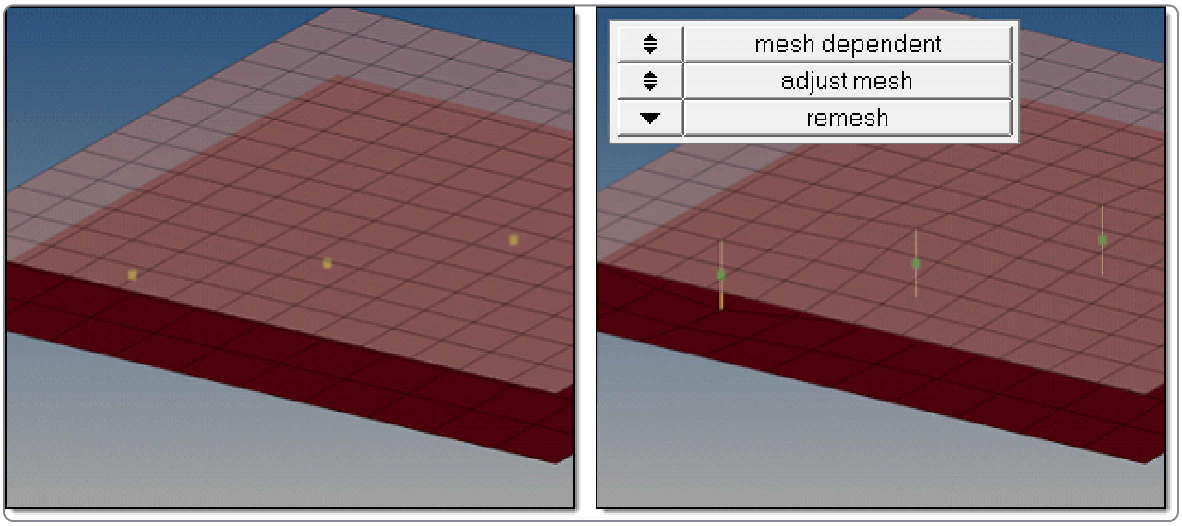
   The mesh will not be modified, at the expense of non-normal or incomplete realizations. Many realization types are defined with head elements attached to body elements. In the case of these realization types, the head elements realize the connection without modifying the mesh. Then the body element is still created in a normal direction.

3. Select a method for performing adjustments.

Adjust Mesh

remesh

Takes the projection points into account and uses snap and split capabilities to connect the weld to the links.



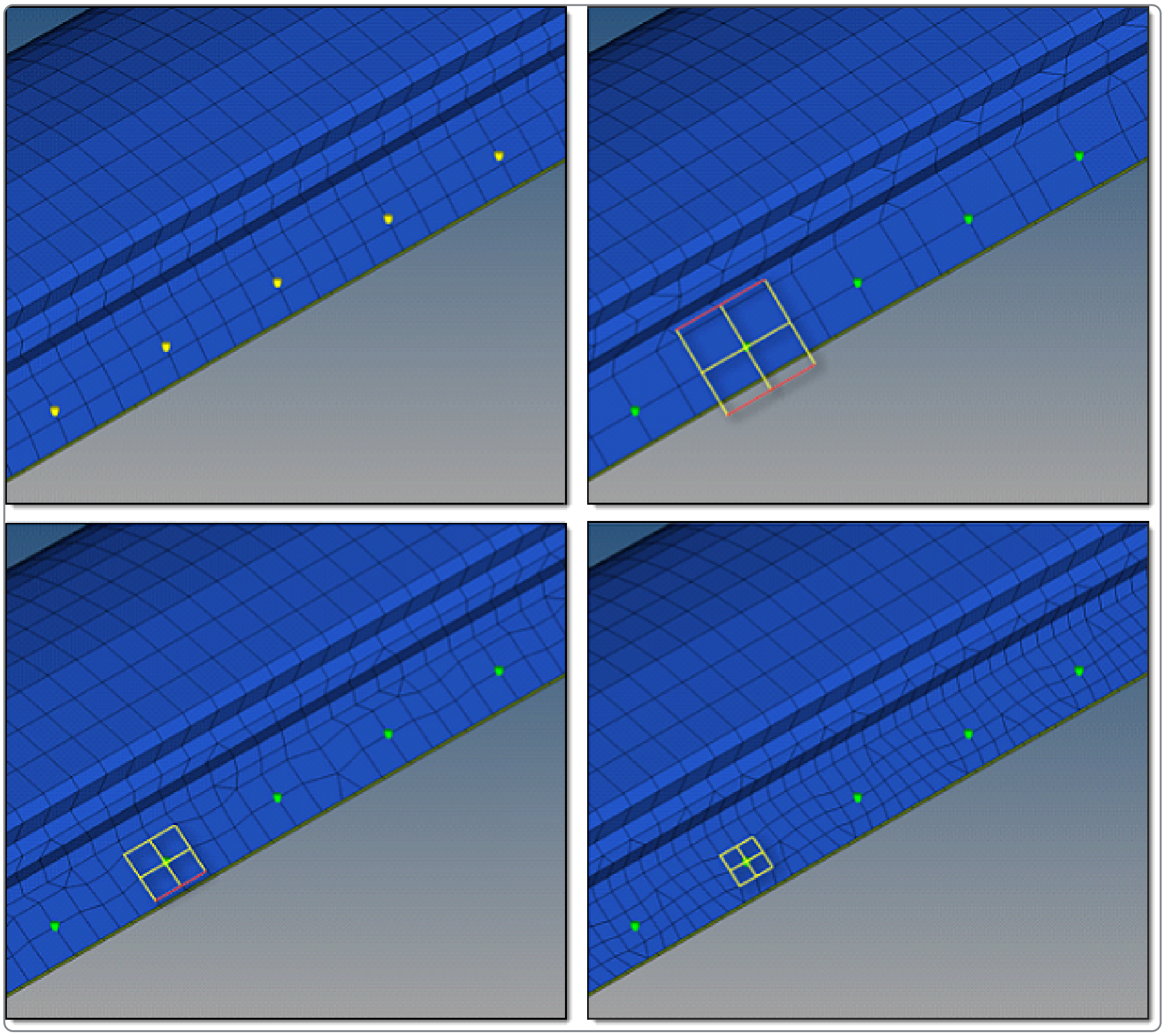
quad transition

Creates perfectly shaped quad elements around the projection points. By default, the quad size is determined by the average mesh size. Alternatively, you can specify a specific quad size in the Quad Size field.

For point quad transition, the automatic snapping and feature detection option, **Allow Snapping**, is activated. This prevents the creation of elements that are too small and ensures that the geometry is not modified too much.

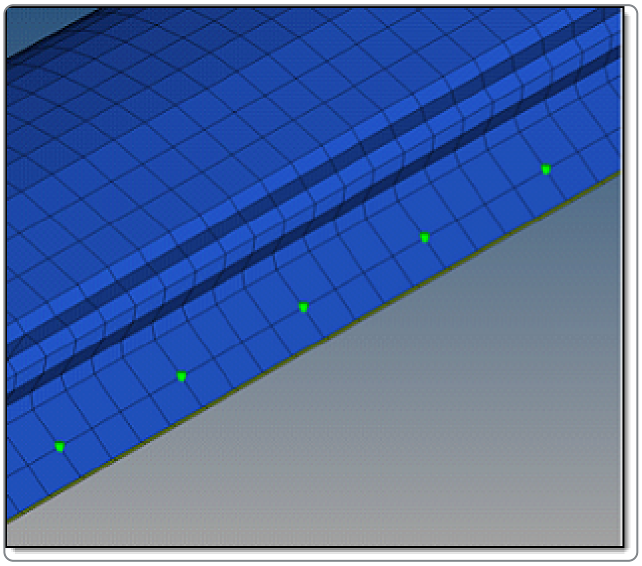
Free edges and features with an angle greater than 25° are always taken into account. If smaller feature angles should be considered, decrease the value in the Feature Angle field under the Behavior heading. Feature angles smaller than 5° will not be considered at all.

By default, snapping is allowed by a distance of one third of the quad pattern element size. In the case of a predefined quad pattern element size of 10.0, the outer nodes can snap to features in a distance of 3.3. The algorithm also tries to snap all three nodes of a quad pattern or none.



The top, left image illustrates the initial model situation. The remaining images illustrate connectors that have been realized with quad transition using different quad pattern sizes: average, coarse, small. The regular quad pattern size is highlighted and the red lines illustrate which nodes have been snapped to a relevant feature or free edge.

The image below is the same example as above, except the model is realized as a quad transition with an adequate quad pattern size.



In Figure 2, points were created at the same exact position, though there is a notable difference. In both images, the connectors have been created along a line, but in the left image the **split to points** option was enabled.

Therefore, in the left image, the quad transition pattern is aligned to the mesh; in the right image, the quad transition pattern is oriented along the point connector line. All elements around the point connector line belong to the regular pattern. The number of element pairs created along the point connector line between the point positions depends on the average or selected mesh size, which can range from one to many. The quad elements are distributed equidistant along the line.

In curved regions the inner and outer lengths of the element edges differ.

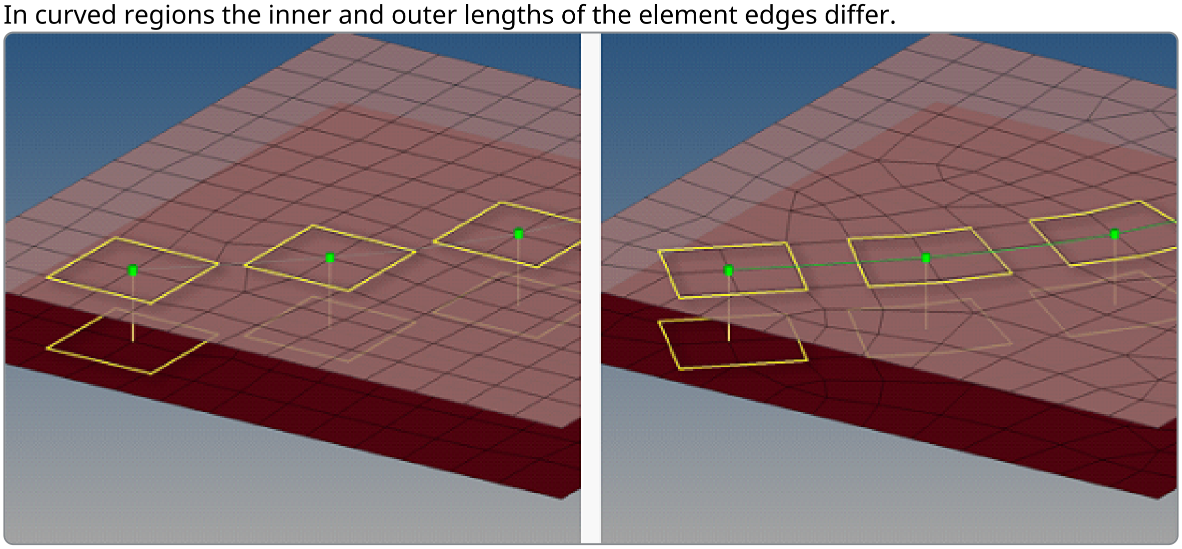


Figure 2.

Adjust Realizations

find nearest nodes

Only searches for the nearest nodes within the given tolerance, making it possible to connect t-joints and similar areas. This option is very useful in situations where the connectors are not positioned perfectly. The realizations are allowed to be non-normal.

Find nearest node does not perform projections.

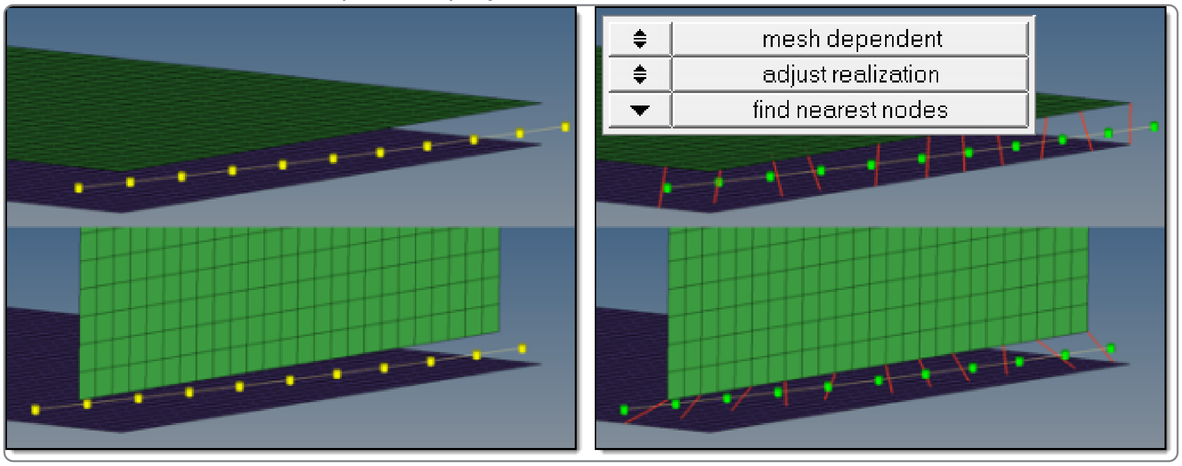


Figure 3.

project and find nodes

Requires a valid normal projection onto the link entities in a first step. In a second step, the nodes closest to the projection points will be used for the connection. If a normal projection is not possible, the realization fails as indicated in the image below.

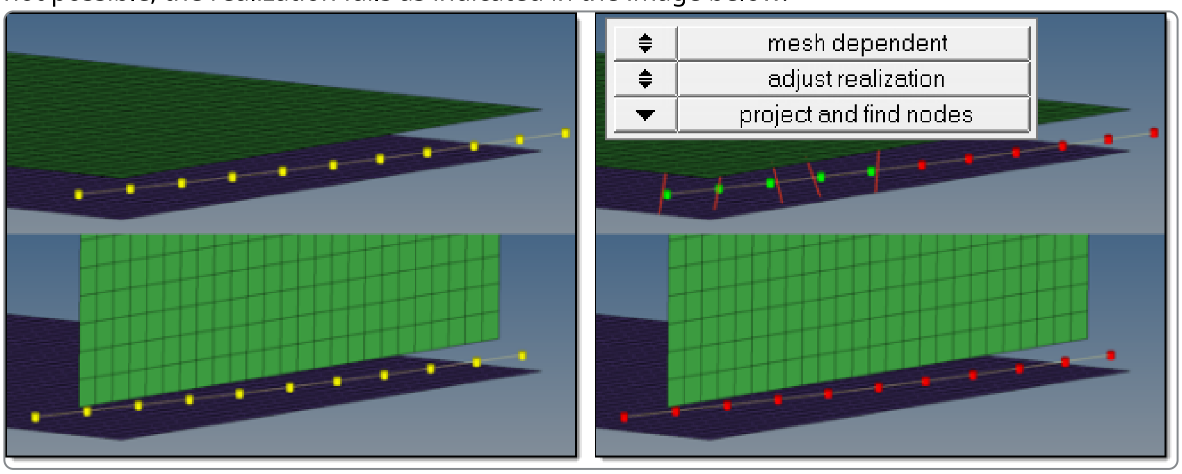


Figure 4.

An angle of less than five degrees is considered normal. Activating the **Nonnormal** checkbox under the Behavior heading omits the requirement for a normal projection and permits links to only be found in the connector tolerance. The result is exactly the same as it is for the **find nearest nodes** option.

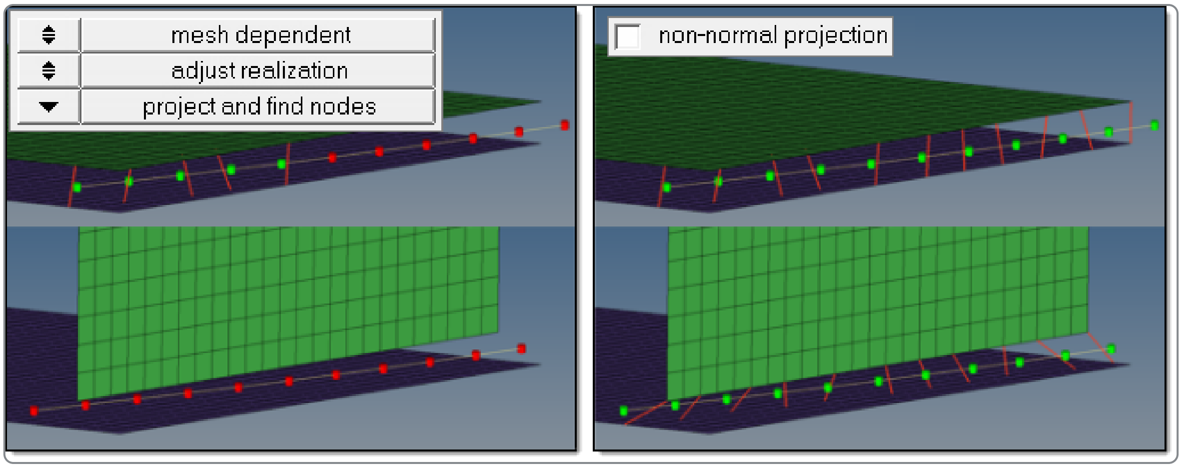


Figure 5.

ensure projection

The minimum condition for the realization is a possible projection. The realization will be performed in the direction from one projection point to the next. If the projection point is coincident with a shell node they will be equivalenced.

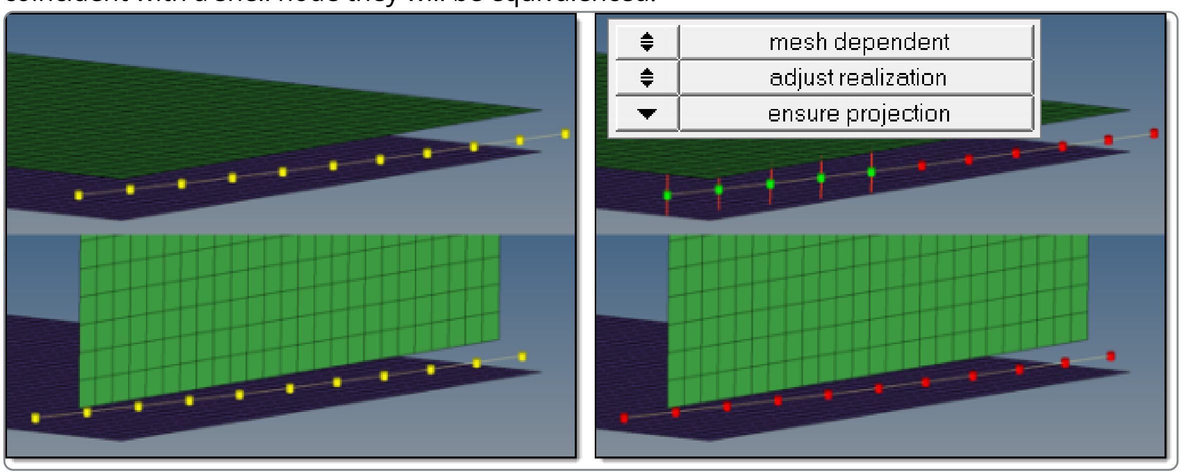


Figure 6.

Note: Ensure projection can lead to incompletely defined connections from a solver perspective unless the connector positions are not aligned to the mesh. The advantage of this projection method is the exact determination of the projection points.

Enabling the **Nonnormal** checkbox allows the realization to be performed from one projection point to the next.

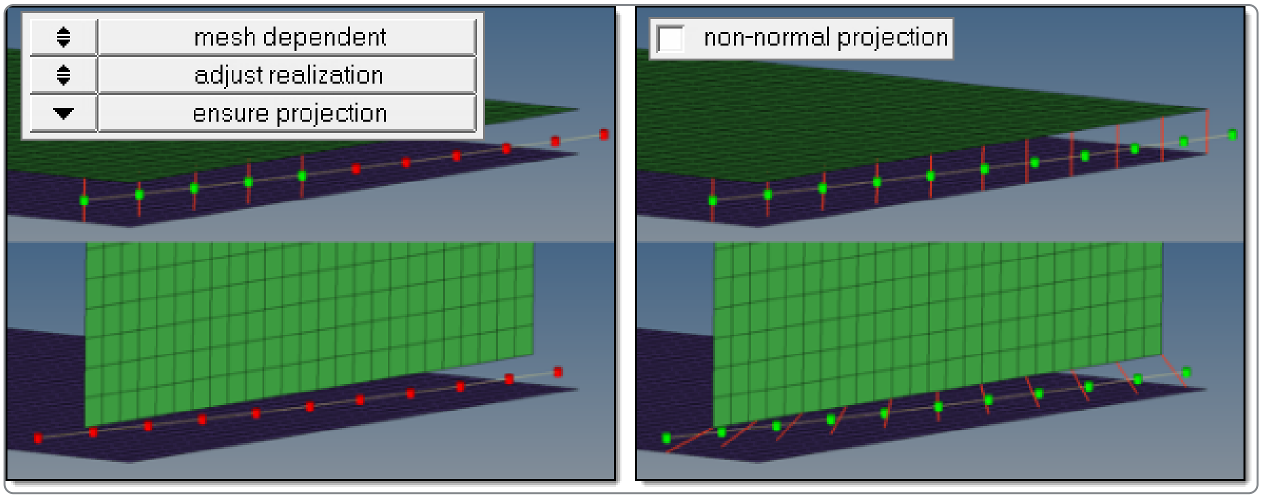

mesh dependent
adjust realization
ensure projection
non-normal projection

Figure 7.

4. If you selected **quad transition** in step 3, define imprint options.

imprint

When creating mesh-dependent realizations with quad transitions, the quad transition meshes can overlap and disturb each other if more than one set of connectors is created too close to each other. Imprint reconcile such transitions with each other and modifies the underlying mesh to match the results. This creates a final result that is seamless and properly meshed.

The option **Resolve Conflicts** is activated by default, enabling smaller imprint conflicts to be automatically resolved when connectors are realized. Overlapping elements are released, and a normal remesh of that area is performed as long as the overlapping area is smaller than half the regular quad transition element size.

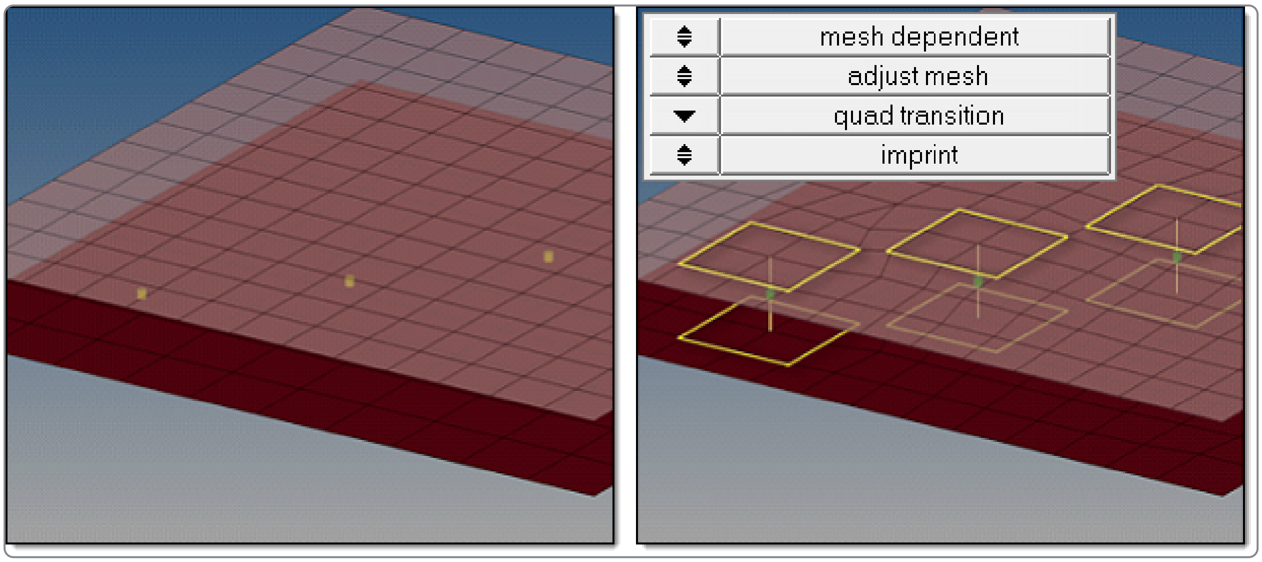


Figure 8.

skip imprint

Prevents the last step of quad transition from being performed. The component ^conn_imprint is created instead, which contains the element pattern. These elements can be modified and manually imprinted later using the Connector Imprint panel.

Skip imprint allows you to realize such mesh-dependent realizations in very complex areas of the model where the automatic imprint fails because of issues such as conflicting points.

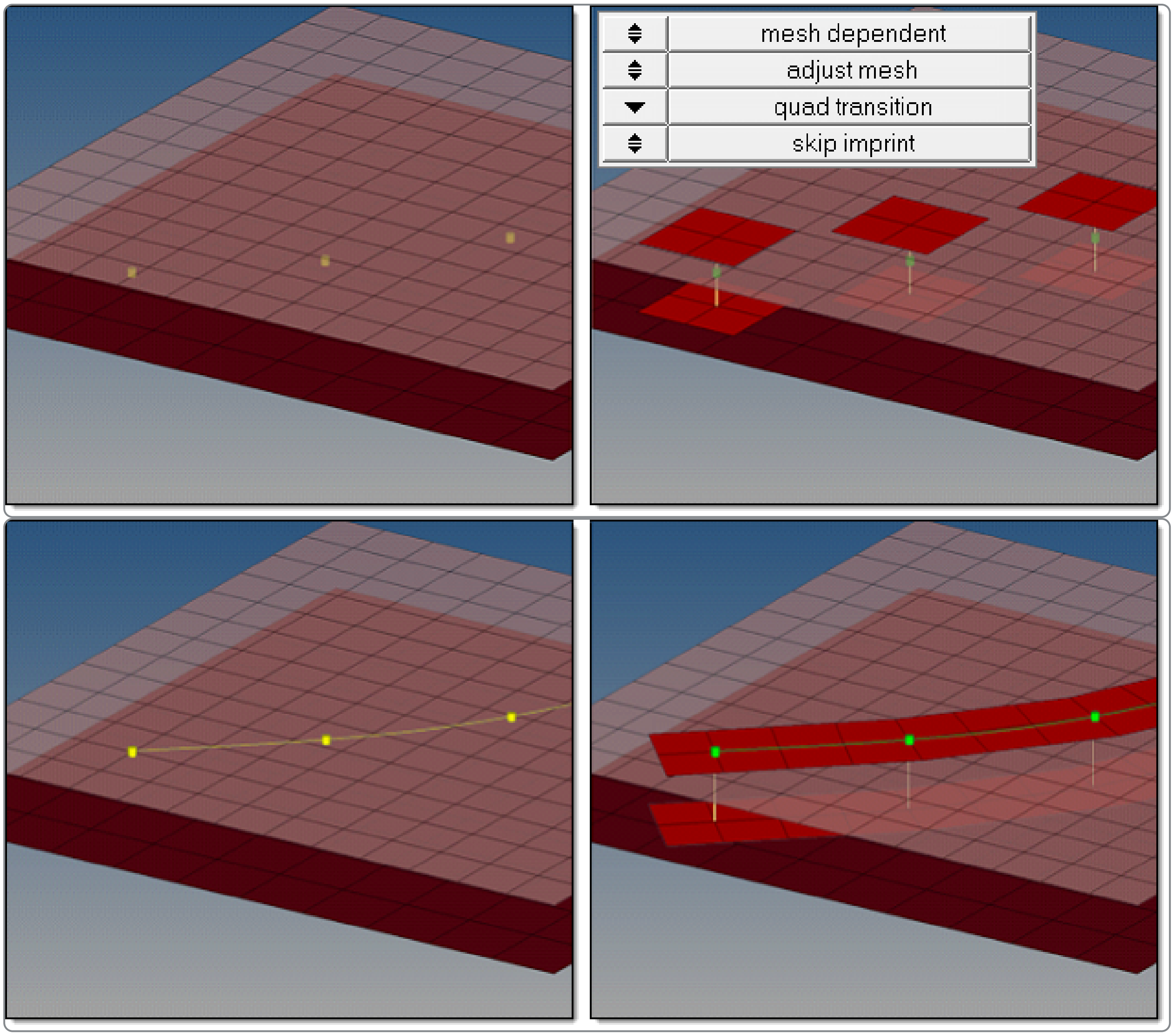


Figure 9.

After Imprint

During realization, if the mesh is altered to realize the connector, this option allows you to select between "Remesh" and "Rebuild" meshing algorithms.

Located under the Behavior heading.

5. If available, define a diameter value.

   This field is used for realizations based on hexa elements such as ACM, where the size of the realized element (hexa, and so on) is created based on the diameter value, or for certain realization types where the diameter is used by a post script.

   The size of the hexa face is calculated from the diameter value $\alpha = \sqrt{d^2 \cdot \frac{\pi}{4}}$.

   When you have weld nuggets from hexa patterns (more than one hexa), the diameter will be measured from two opposite nodes.

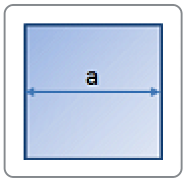


Figure 10. Hexa

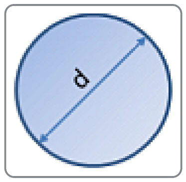


Figure 11. Weld Nugget

diameter
: Specify a single diameter value.

diameter mapping file
: Obtain diameter values that you assigned to a range of flange thicknesses in the Diameter Table.

  Along with flange thickness ranges, you can also specify the main flange thicknesses to consider when assigning diameter values.