Altair HyperWorks™

2022

Line Realization Methods

Overview of the line connector realization process and methods.

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

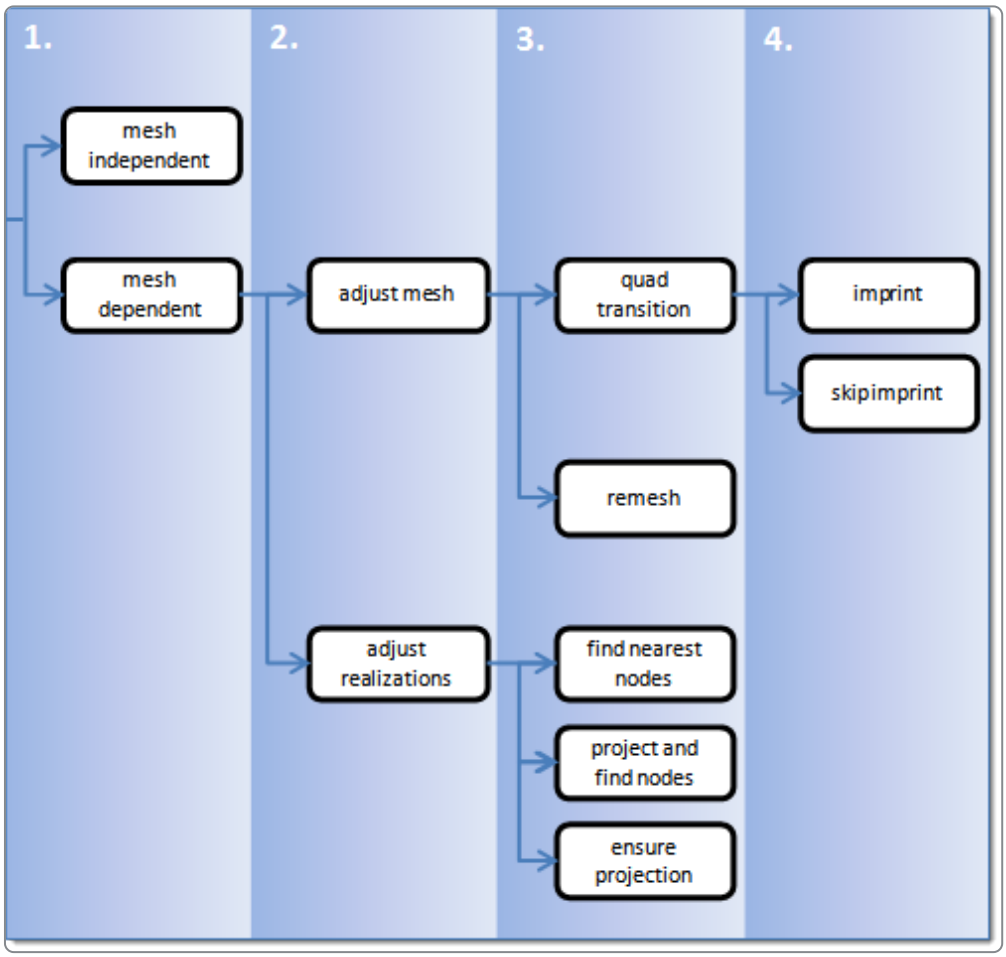

Figure 1.

1. Select the realization type.

   mesh independent

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

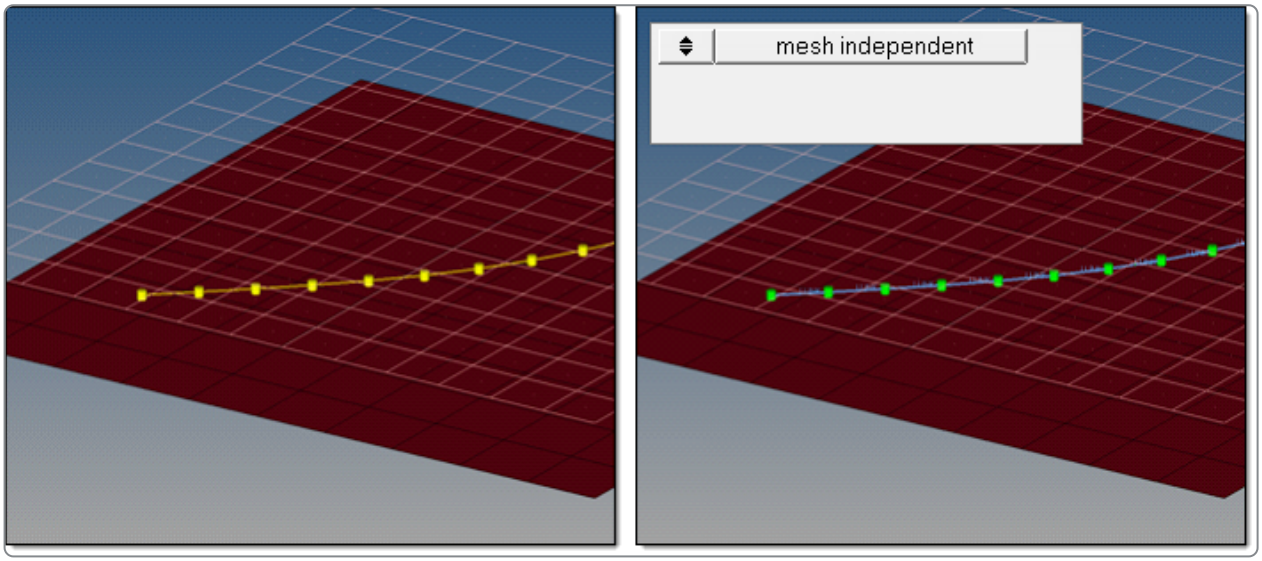

Figure 2.

   During the realization, the solver-specific connection is created. For example, for the PAM-CRASH LLINK, all necessary solver-specific cards are created along with the realization.

   mesh dependent

   Use for all other cases.

2. If **mesh dependent** is selected, you must decide 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 realization

   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, and the body elements are created in a normal direction.

3. Select a method for performing adjustments.

Adjust Mesh

remesh

Connects the weld to the links using snap and split capabilities.

Note: Remesh does not look for a correct t-edge in the case of a quad realization. This option only ensures that the weld and the mesh have a proper node to node connection in the position of the projection point.

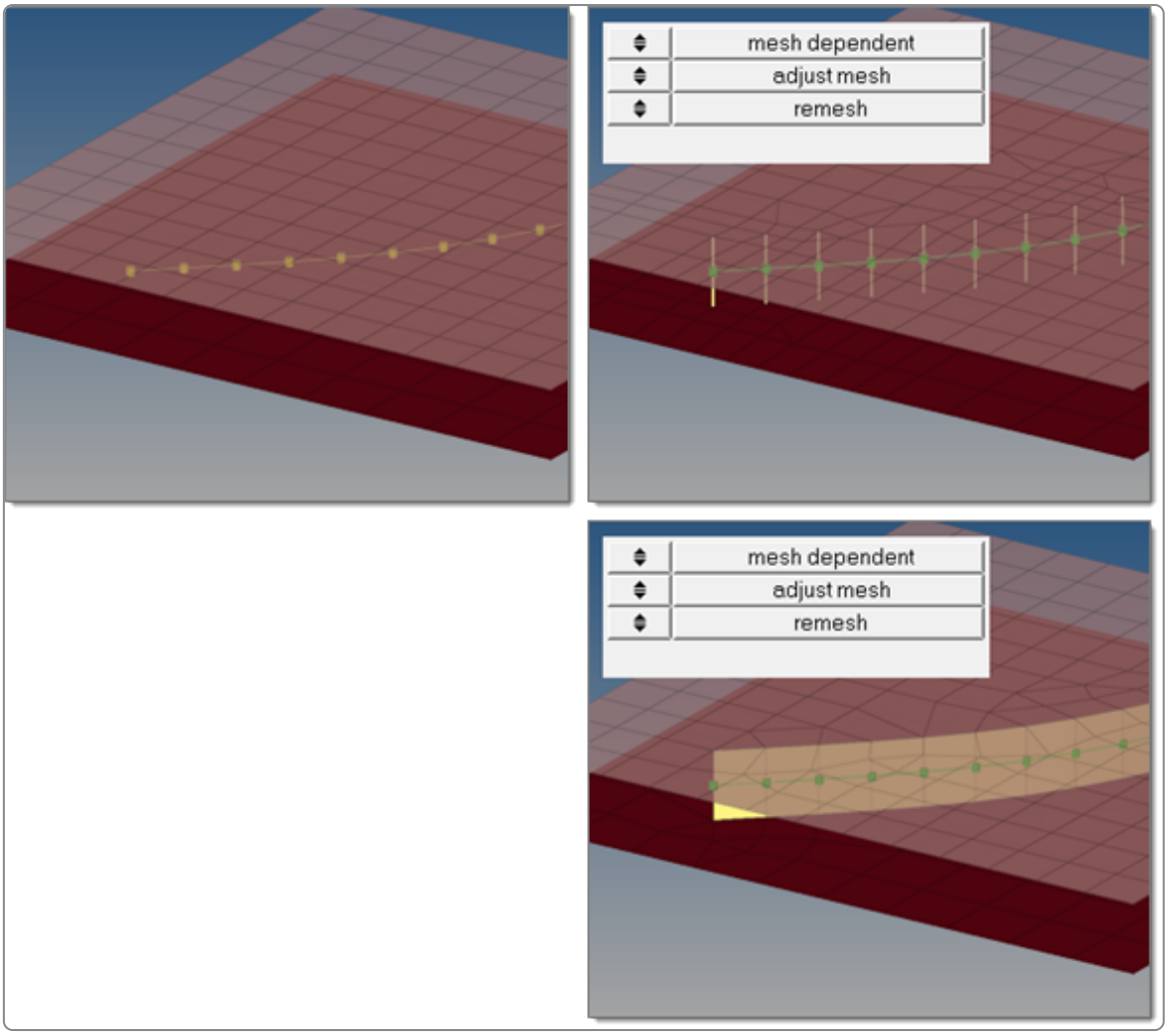

Figure 3.

quad transition

Creates perfectly shaped quad elements around the projection line. The quad size is determined by the average mesh size. From one projection point to the next, exactly one pair of elements is created. You can also use this option to create lines from quad elements and realize the connections to the links through perfectly modeled t-edges.

For line quad transitions, 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.

Adjust Realization

find nearest nodes

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. These realizations are allowed to be non-normal.

Find nearest nodes does not do any projection.

Note: If the connector points are close to each other and two of these points find the same closest nodes, the connector fails.

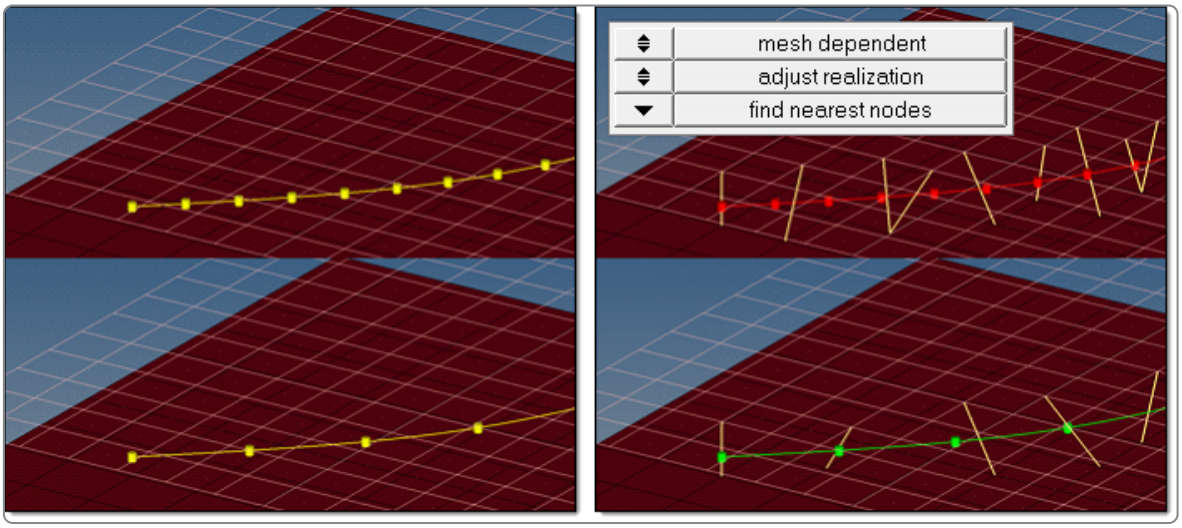

Figure 4.

project and find nodes

Requires a valid projection onto the link entities in the first step. In the second step the nodes closest to the projection points will be used for the connection. If a projection (connector tolerance) is not possible, the realization fails. Because a non-normal projection for lines is always allowed, the results will be exactly the same as the results for **find nearest node**.

Note: The realization fails when the connector points are close to each other, and two of these points find the same nodes.

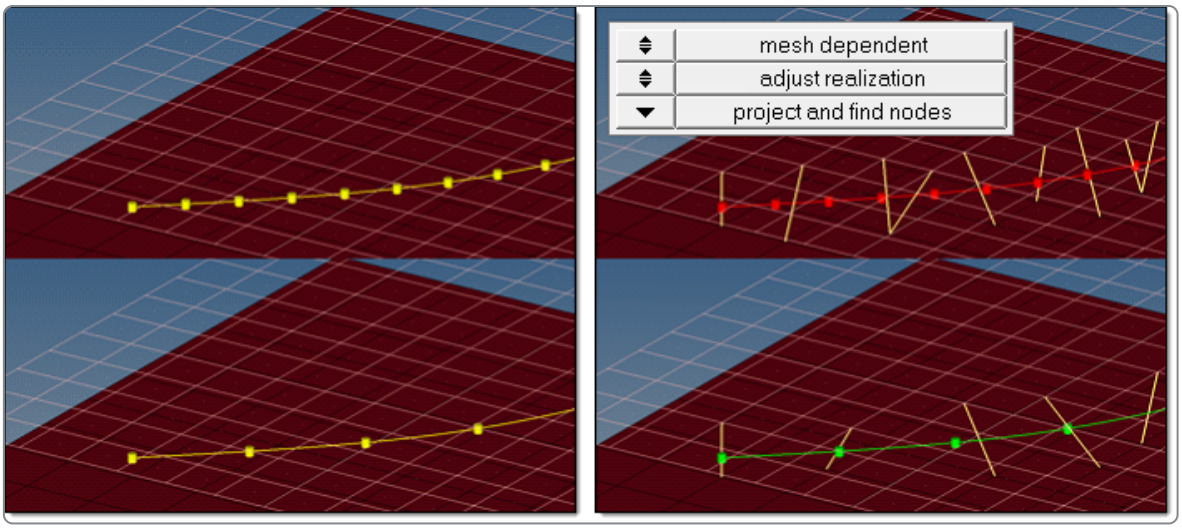

Figure 5.

Ensure projection

The minimum condition for the realization is a possible normal 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.

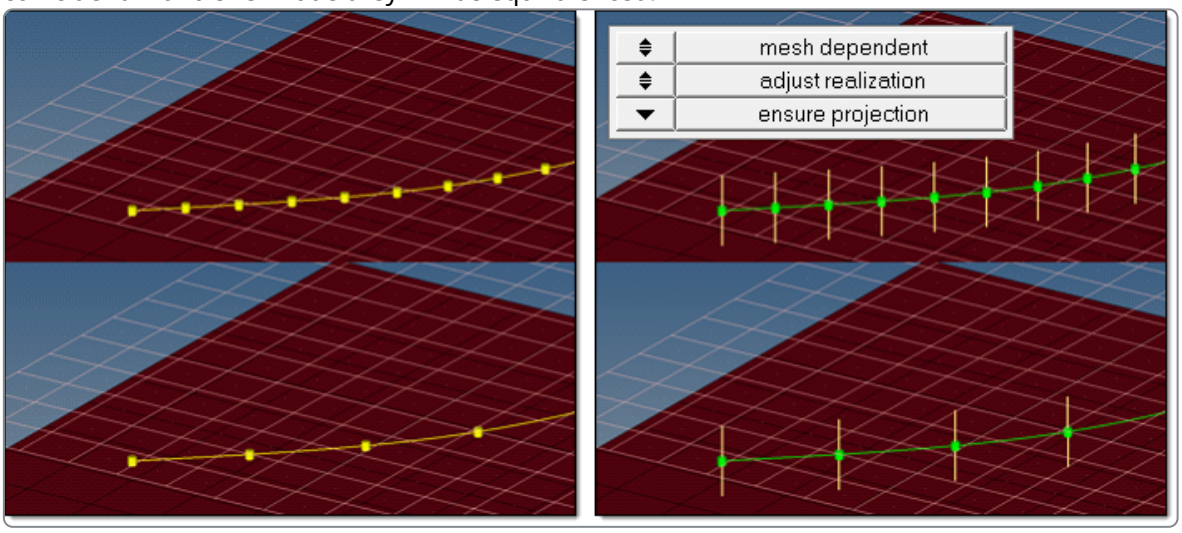

Figure 6.

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.

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. The imprint option reconciles such transitions with each other and modifies the underlying mesh to match the results to create 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.

The size of the imprint can be determined using the pitch size (**use pitch size**) or using the average size of the underlying mesh (**use avg. mesh size**). If you want to define a specific imprint size, select **user input size**.

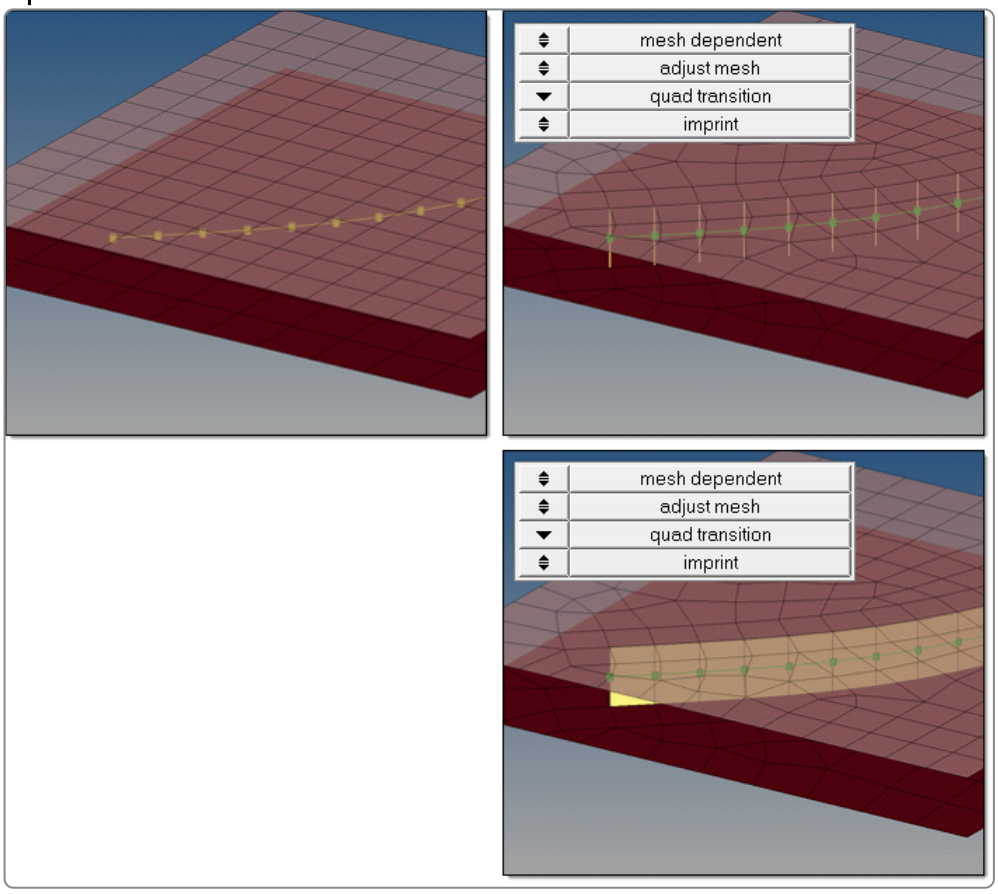

Figure 7.

skip imprint

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

Skip imprint enables 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 lines.

The size of the imprint can be determined using the pitch size (**use pitch size**) or using the average size of the underlying mesh (**use avg. mesh size**). If you want to define a specific imprint size, select **user input size**.

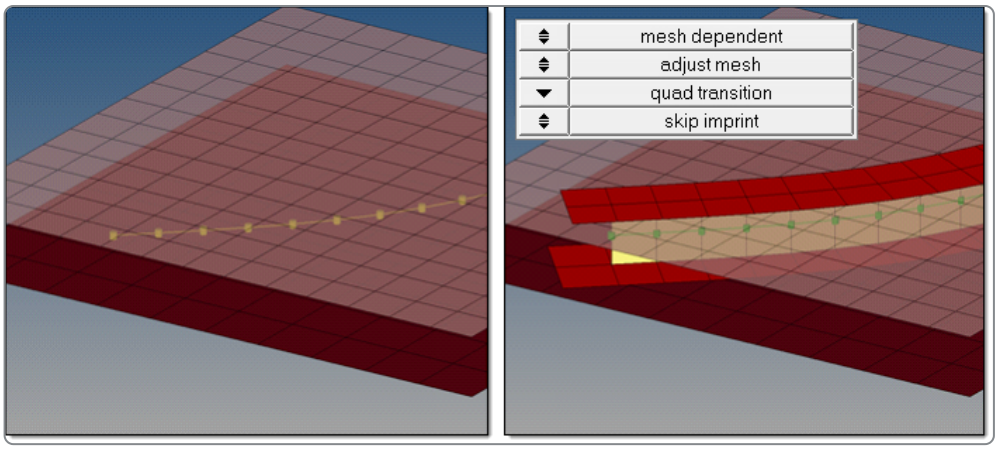

Figure 8.

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.

Note: Historically, the connector spot lines and seam lines have contained a test point distributed evenly between the start and the end points of the line. This, however, would mean that the test points could lie between a corner, and as a result the corner would be missed. Connector lines now allow the connector to create Significant Points between features of the lines – for example, corners. The connector then interprets the test points between the significant points.

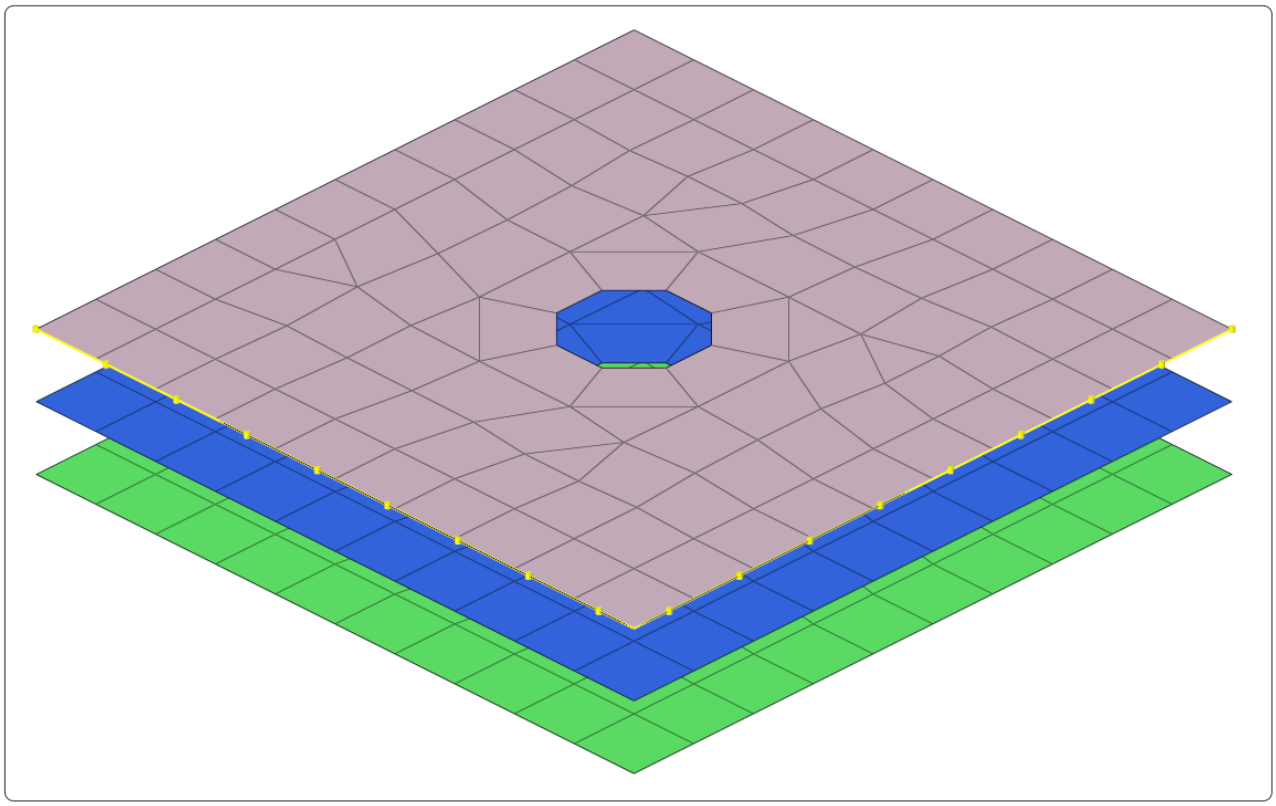

Figure 9.

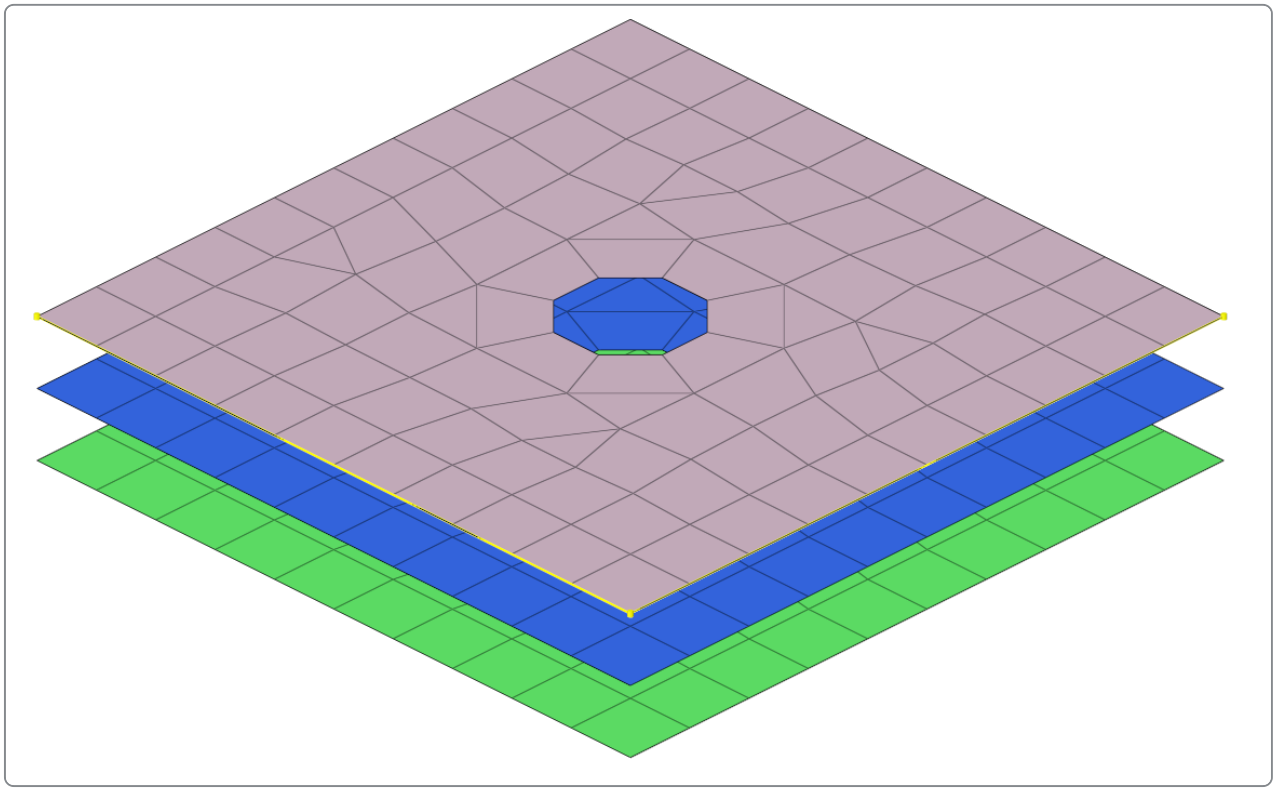

Figure 10.