

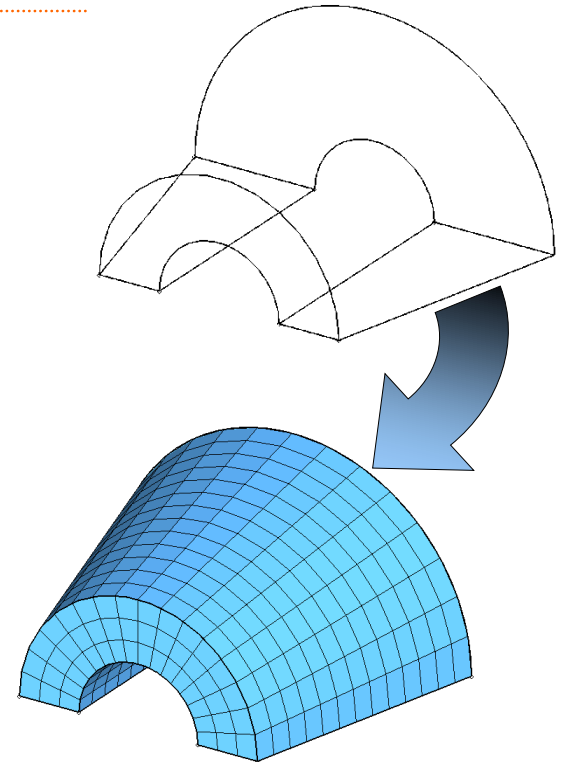
# Chapter 4: Solids and Hexas

**Creating a Hexahedral Mesh using the  
Solid Map Function**

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# Solid Map: What is it?

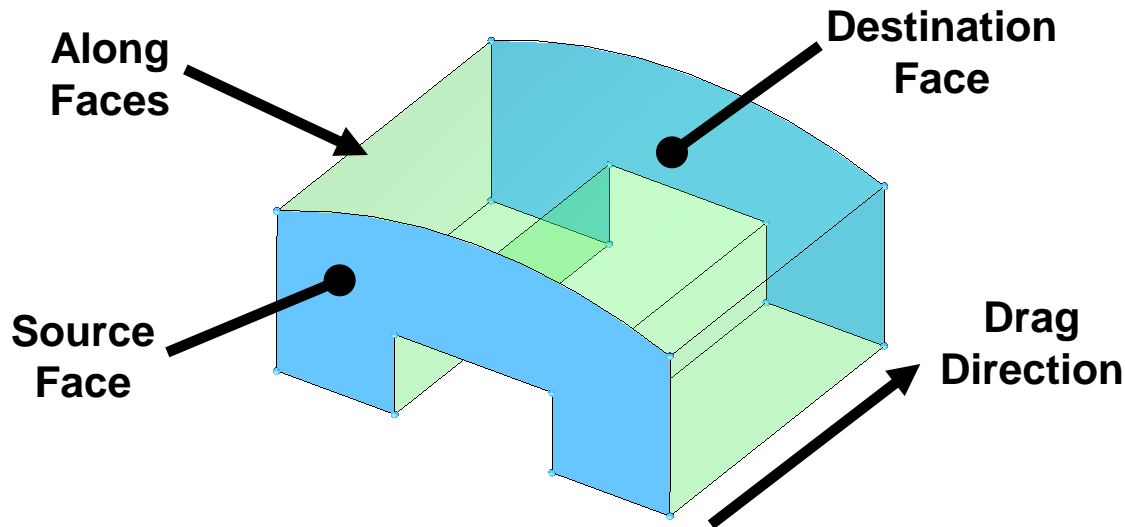
- Location:
  - **3D** (page) > **solid map** (panel)
  - OR -
  - **Mesh** > **Create** > **Solid Map Mesh**
  
- What it does:
  - Creates hexa-penta mesh in 1 or more volumes
    - Each volume is defined by selecting a solid geometry entity
      - Easy to define shape for the mesh since only one entity is selected
  - Each volume must be a “mappable shape”



<input checked="" type="radio"/> general	source geom: <input type="text" value="surf"/>	dest geom: <input type="text" value="surf"/>	along geom: <input type="text" value="surfs"/>	along parameters: <input type="text" value="10.000"/>	<input type="button" value="mesh"/>
<input type="radio"/> line drag				elem size=	<input type="button" value="reject"/>
<input type="radio"/> linear solid				along bias style:	
<input type="radio"/> ends only	elems to drag: <input type="text" value="elems"/>	elems to match: <input type="text" value="(none)"/>		<input type="text" value="linear"/>	<input type="button" value="equiv/faces"/>
<input checked="" type="radio"/> one volume				intensity=	<input type="text" value="0.000"/>
<input type="radio"/> multi solids					
<input checked="" type="checkbox"/> show solidmap mesh		<input type="checkbox"/> smooth dest	<input type="checkbox"/> apply orthogonality to along		<input type="button" value="return"/>

# Solid Map Volume: Mappable Shapes

- **Solid Map** requires solid geometry of mappable shapes
- Mappable shapes are defined as:
  - 2 opposing faces (called “**source**” and “**destination**” faces)
  - 1 or more faces that directly connect the source and destination
    - These enclose the volume between the source and destination
    - Called “**along faces**”
    - “**Drag direction**”: the vector from the source face to the destination face
      - A volume might be mappable in more than 1 direction



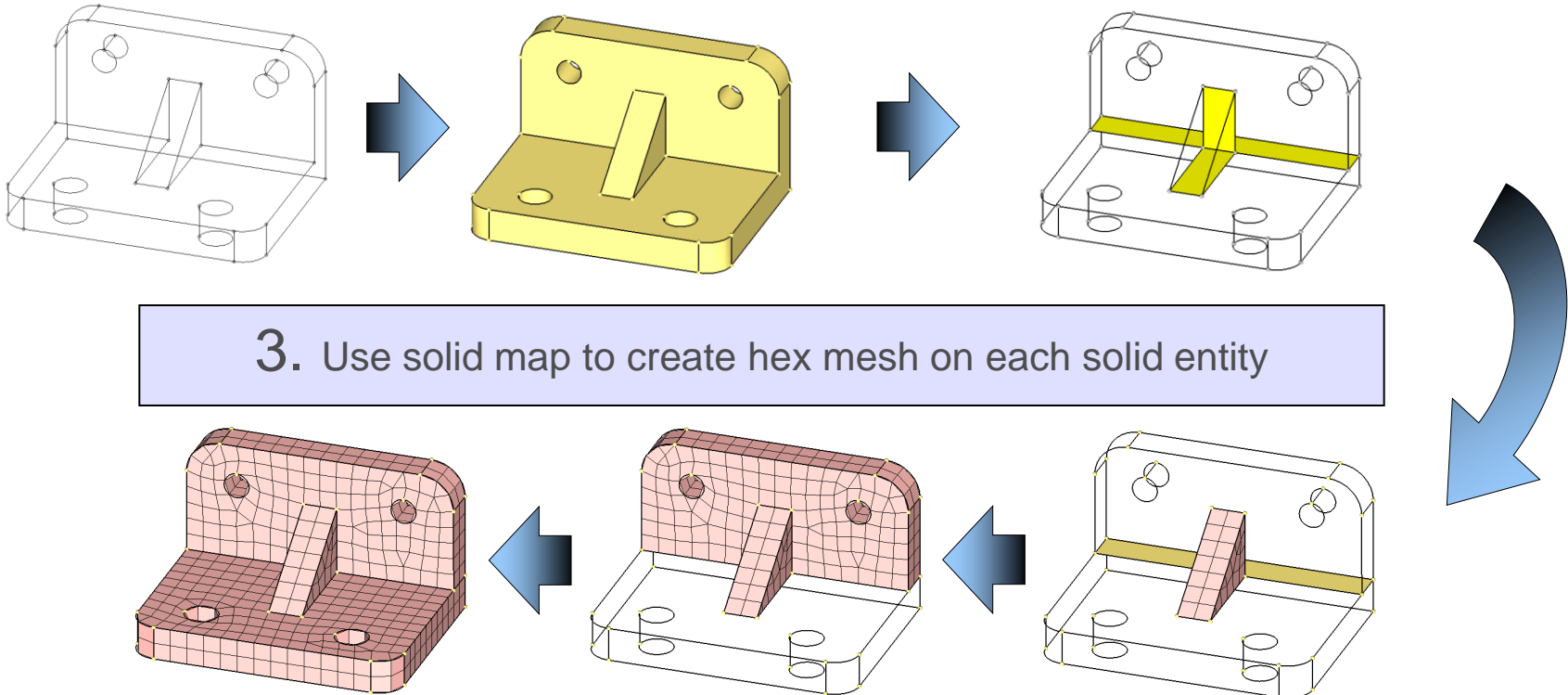
# Solid Map One Volume: Process

- Basic process of using ***solid map: one volume*** is:

1. Create solid geometry

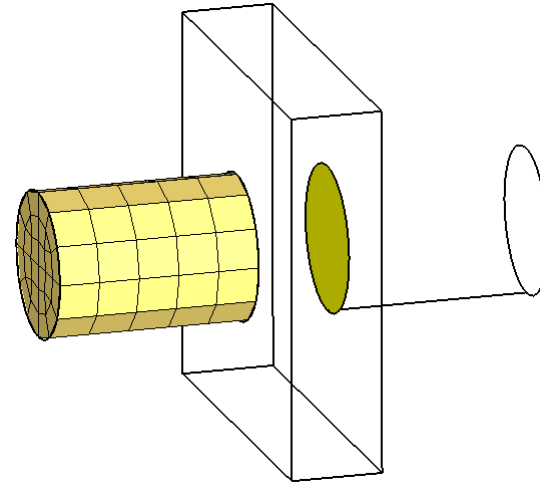
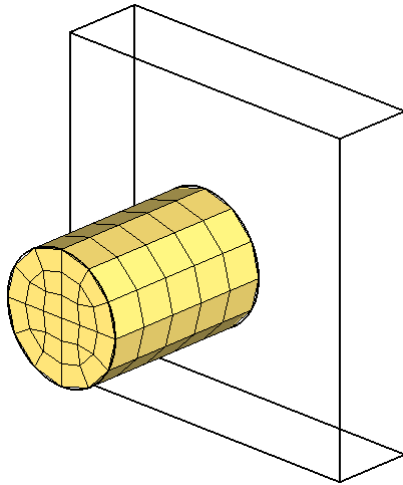
2. Split the solid geometry into mappable regions

3. Use solid map to create hex mesh on each solid entity



# Solid Map Volume: Tips and Requirements

- Source and destination faces
  - Source face can be made of multiple surfaces
    - Edges can be suppressed to make a single surface (if possible)
  - Destination face must be a single surface

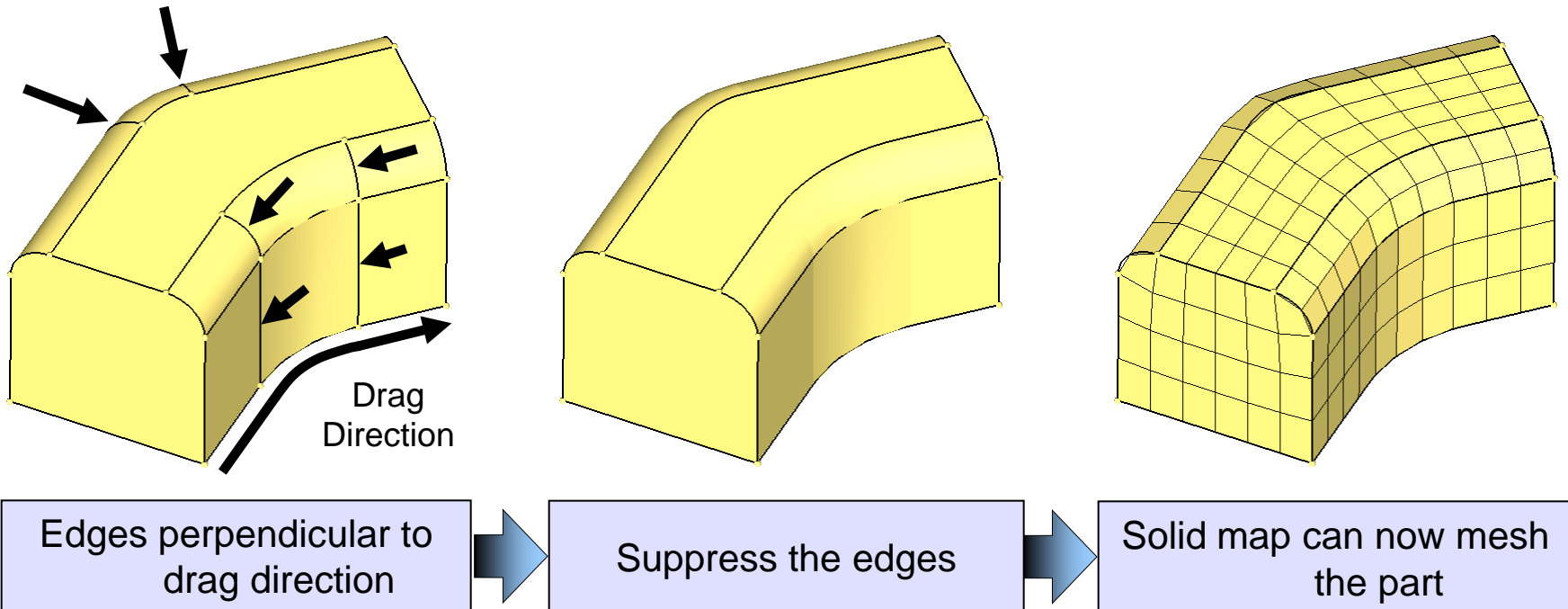


- Solid map will mesh the rectangular region
  - Only 1 side has multiple surfaces (connection to the meshed cylindrical region)

- Solid map will fail
  - Both sides have multiple surfaces (connection to the cylindrical regions)

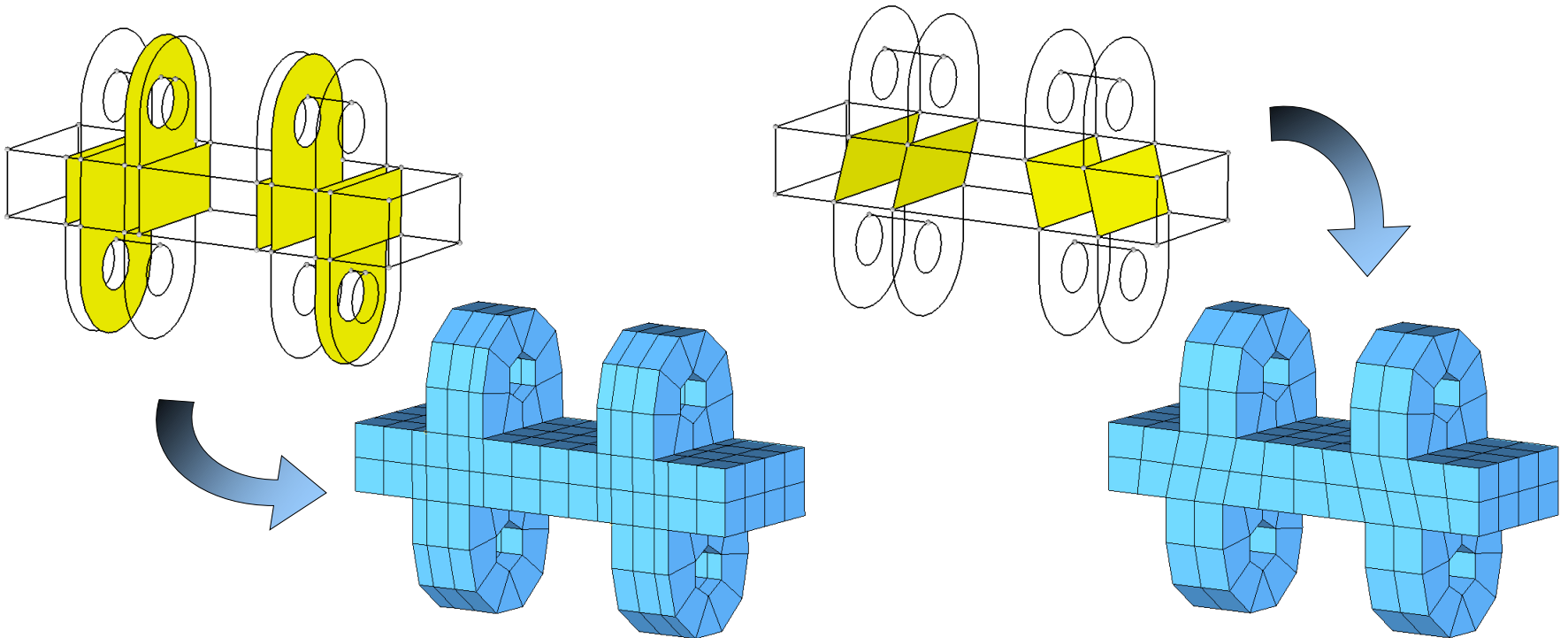
# Solid Map Volume: Tips and Requirements

- Edges and fixed points on along faces
  - Hexa mesh will follow shared edges parallel to the drag direction
  - Shared edges perpendicular to the drag direction cause **solid map : volume** to fail
    - Suppress these edges
  - Hexa meshes will 'ignore' fixed points along drag direction



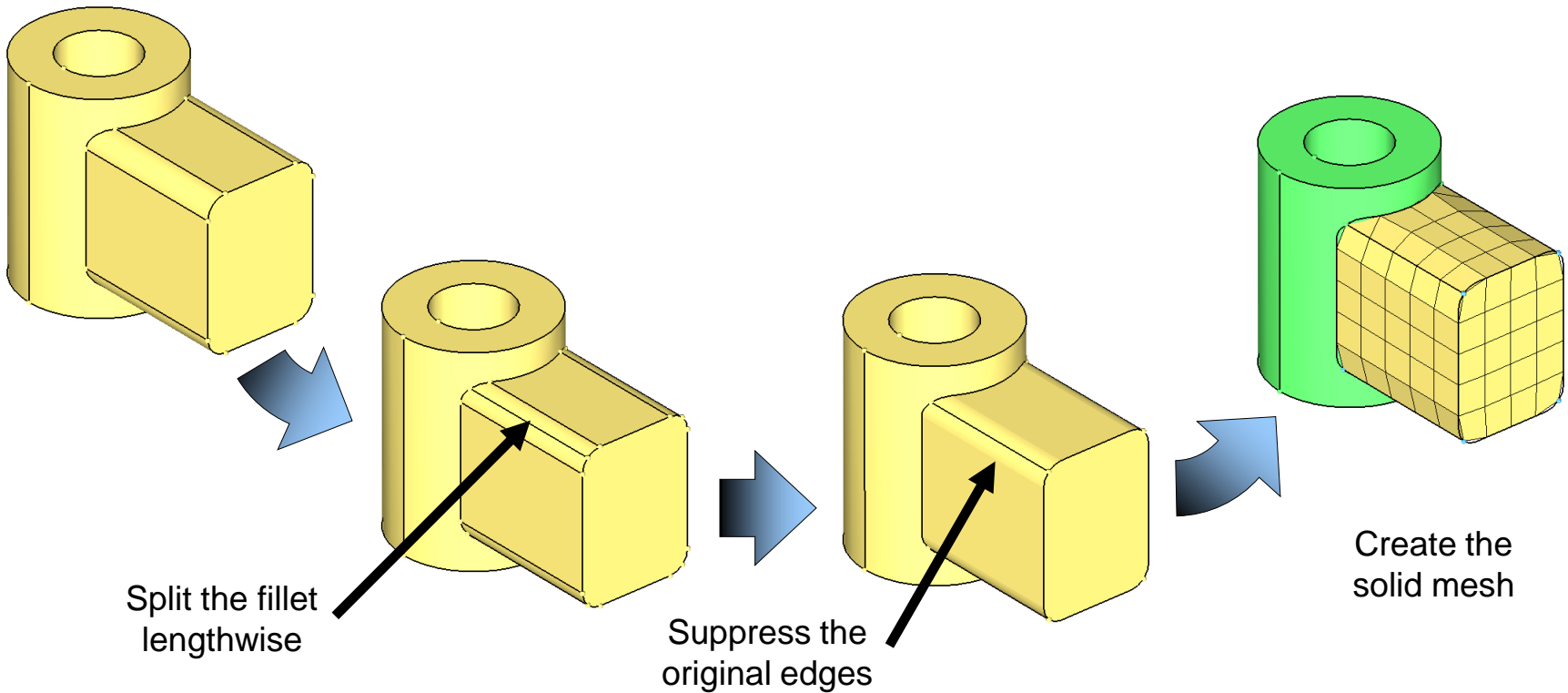
# Solid Map Volume: Tips and Requirements

- Splitting solid geometry
  - Try to divide the part into the fewest regions possible
  - Less divisions = less work = less time
  - Less divisions = larger regions
    - More control over mesh size
    - Not forced to use smaller mesh size due to small regions



# Solid Map Volume: Tips and Requirements

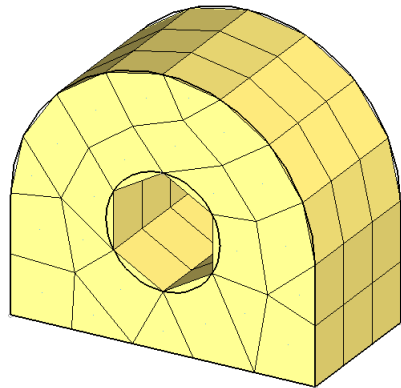
- Fillet control
  - If needed, split the fillet surface along its length
  - Suppress the original fillet edges



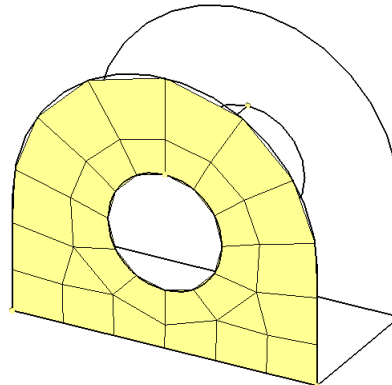
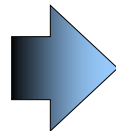


# Solid Map Volume: Tips and Requirements

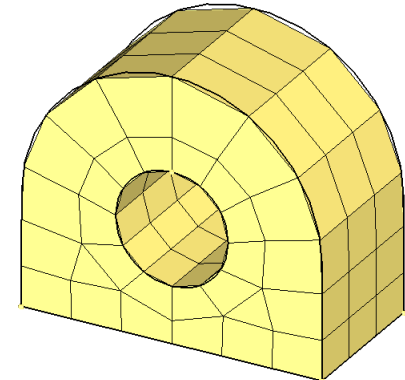
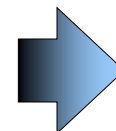
- Controlling mesh pattern with shell mesh
  - **Solid map : volume** will use mesh pattern of shell mesh on the source face
  - Use **automesh** panel (recommended but not required)
    - Automatically associated with the surface
    - Ensures connectivity with adjacent elements
  - Can use other shell meshing panels (**drag**, **spin**, **spline**, etc.)
    - Need to associate the elements to the surface before solid meshing
      - Use **node edit : associate** panel to do this



Default



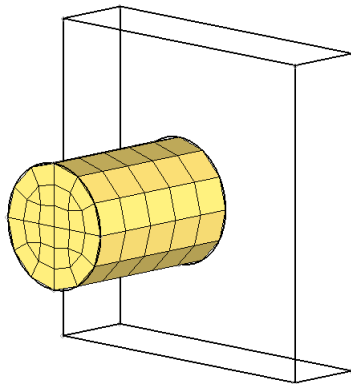
Create shell  
mesh



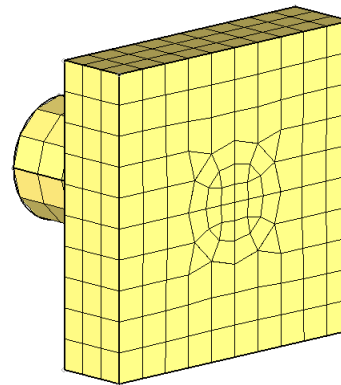
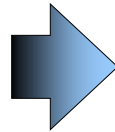
**Solid map** uses the  
shell mesh pattern

# Solid Map Volume: Tips and Requirements

- Meshing adjacent volumes
  - Mesh volumes that are immediately adjacent to volumes that have already been meshed
    - Ensures proper mesh connectivity if possible
    - 2 start points will probably not result in matching mesh patterns
  - Start with smaller volumes
    - Mesh pattern of small volumes will be used on an larger, adjacent volume
      - Must be connected to the source face of the larger, adjacent volume



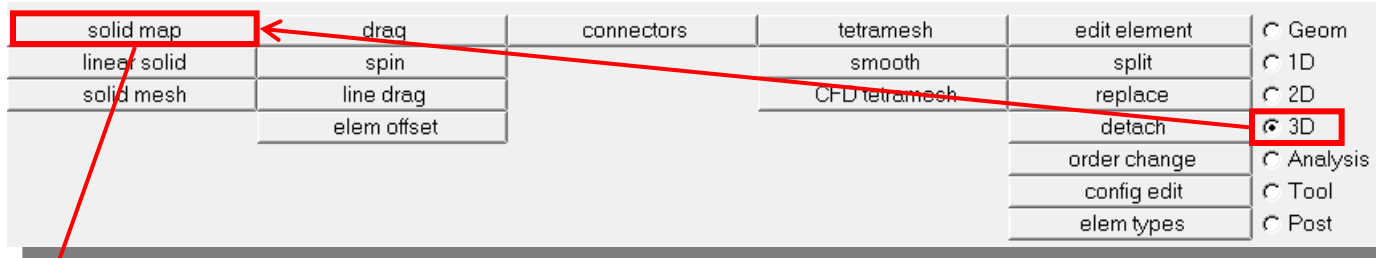
Start with the smaller region



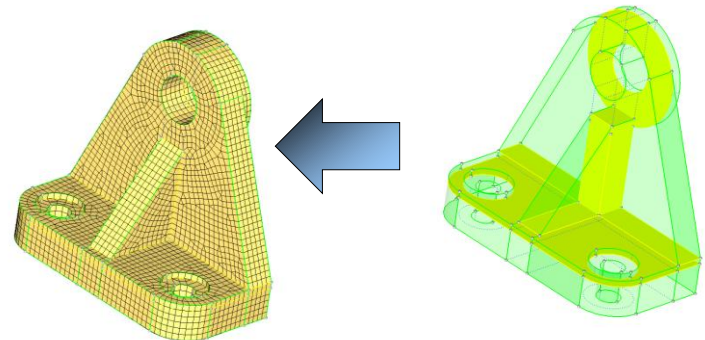
Mesh pattern from the smaller region is carried through the larger

# Solid Map Meshing – Multi Solids

## “Solid Map” Panel → 3D – solid map - multisolids



- What it does:
  - Creates hexa-penta mesh in multiple volumes simultaneously
- Each volume is defined by selecting a solid geometry entity
  - Each volume must be a “mappable shape”
  - Control over node density, mesh method and other mesh controls such as mesh flow are all now possible BEFORE creating the solid mesh.



# Solid Map Volume: Tips and Requirements

- Meshing adjacent volumes, continued
  - Drag perpendicular to adjacent volumes
    - Along faces are always rows/columns of quads
    - Allows adjacent volumes connected by their along faces to be easily connected & equivalenced
      - Avoids discontinuities
    - Manually specify the source & destination faces in ***solid map : volumes***

