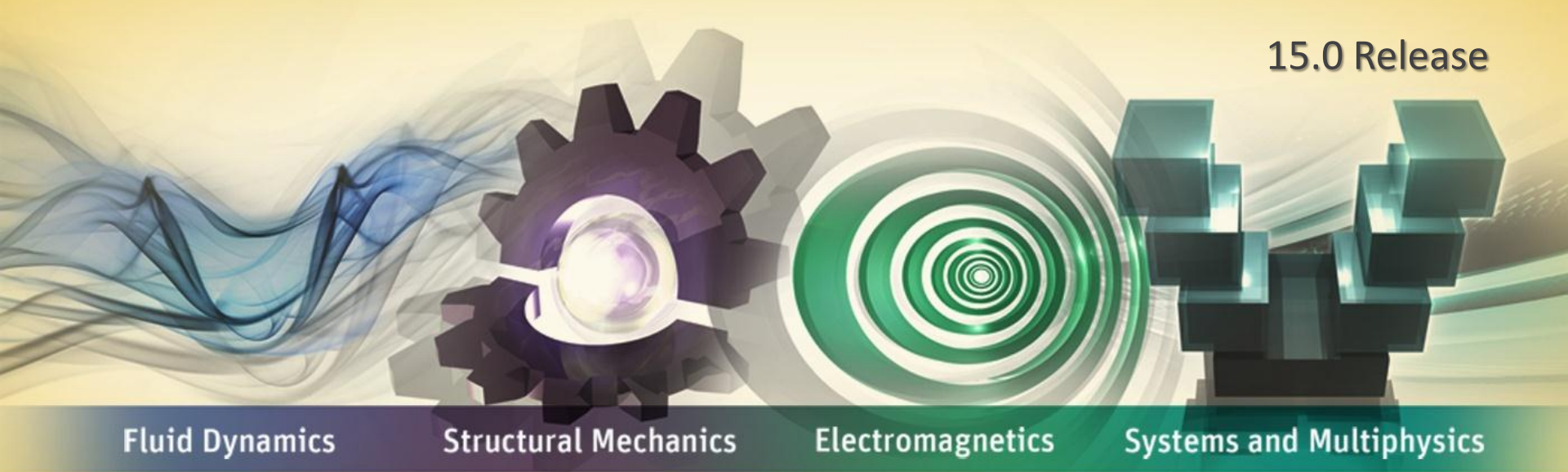


Appendix 7

Additional Hexa Functions

15.0 Release

A horizontal banner with a yellow background. It features four main sections: 'Fluid Dynamics' with a blue wavy line, 'Structural Mechanics' with a purple gear, 'Electromagnetics' with a green concentric circle, and 'Systems and Multiphysics' with a 3D bar chart. The text '15.0 Release' is in the top right.

Fluid Dynamics

Structural Mechanics

Electromagnetics

Systems and Multiphysics

Introduction to ANSYS ICEM CFD

Extend Split

Blocking



- Think of a split as a plane (even though it does not have to be planar)
- Select an edge at the outside of this “plane” and it will extend in all directions
 - Split only goes through the displayed blocks
 - Use the index control to limit the displayed blocks

Split Block



Extend Split

Edge Select

☒ Selected Edge ☐ All Edges

Block Select

☒ Visible ☐ Selected

Block(s)



Edge

☐ Project vertices

Apply

OK

Dismiss

Select **Project vertices** to have it automatically project new visible vertices to the nearest place on their associated geometric entities

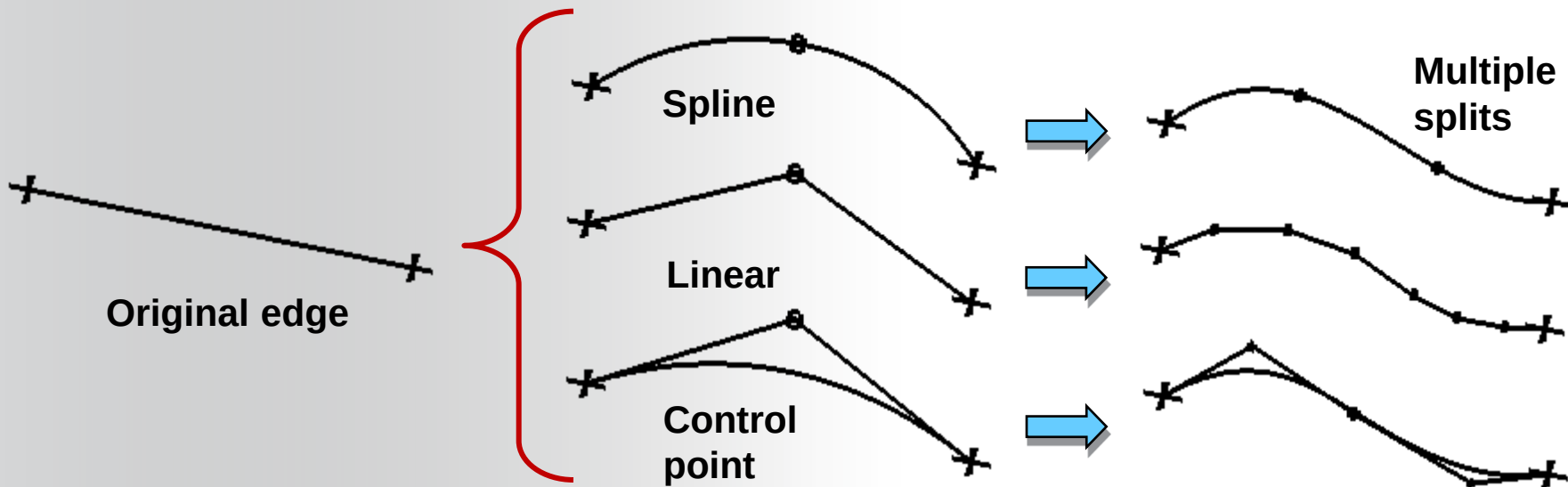
Select edge

Select edge

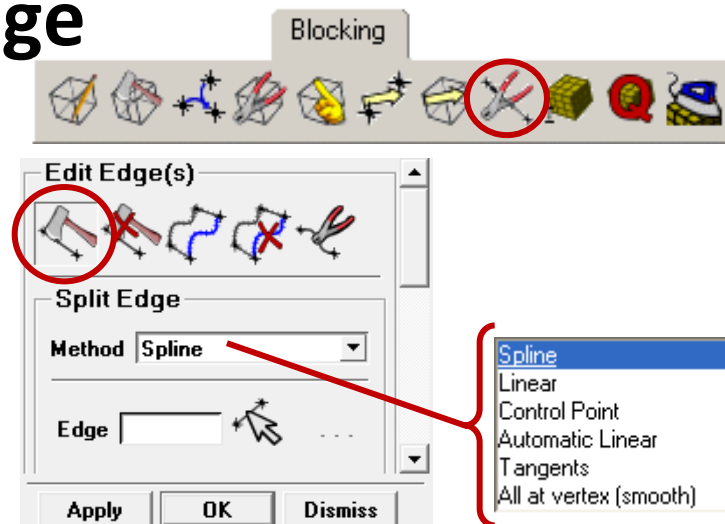


Shaping Edges – Split Edge

- Edges are by default linear before projection
- Edges can be shaped using split edge
 - *Spline*
 - *Linear*
 - *Control point*
- Use *Move vertex* to move splits after splitting

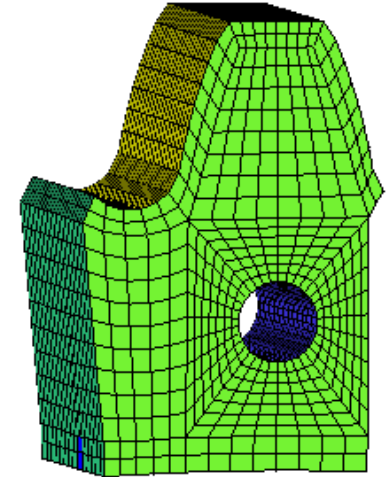
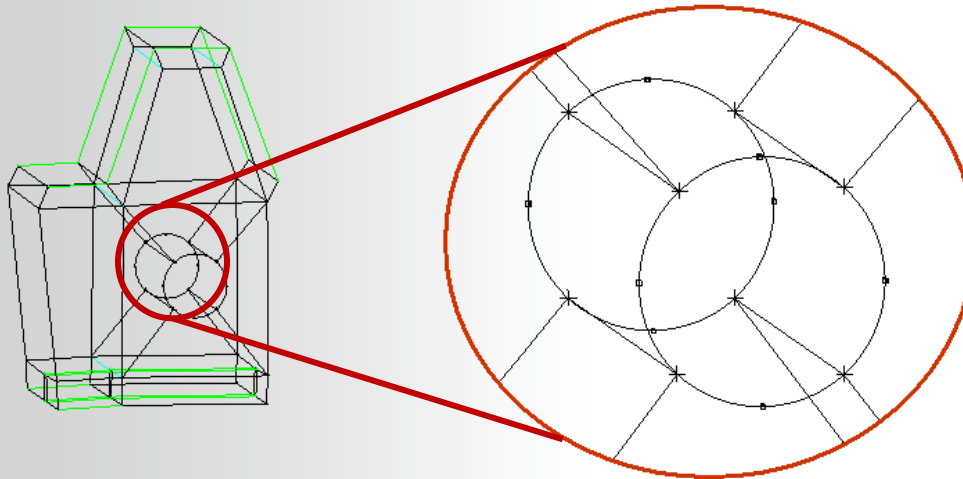
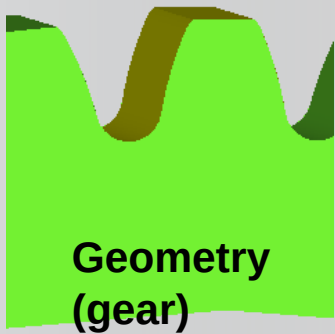


- Split edge will also override the automatic interpolation of edges during mesh computation

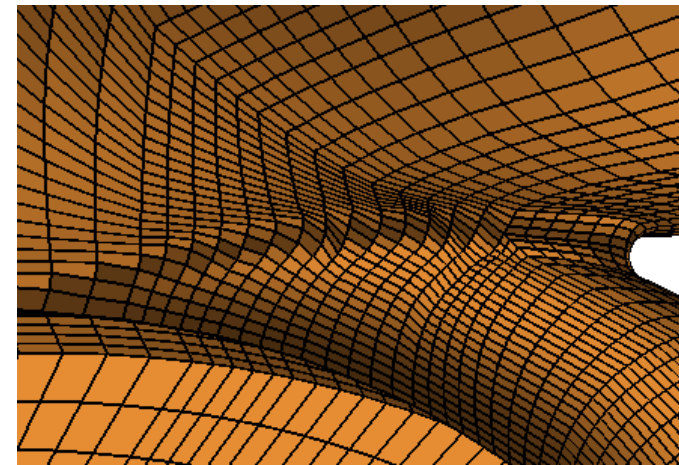
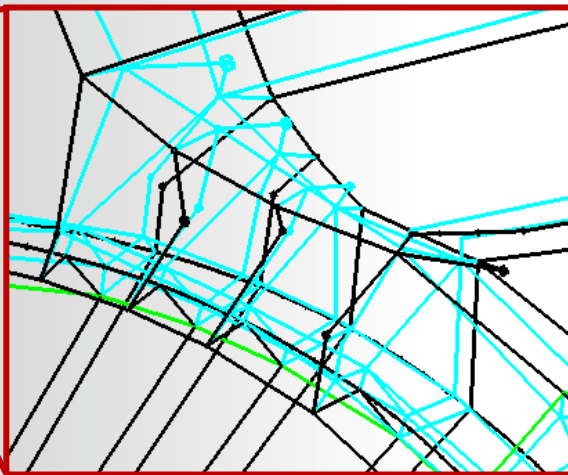
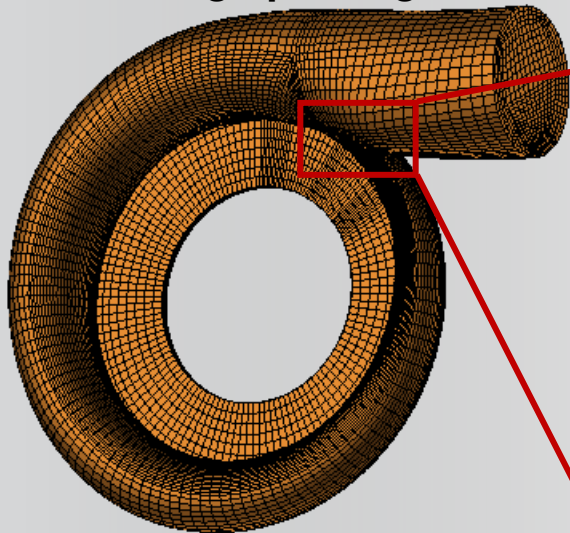


Shaping Edges – Split Edge Example

- Using split edge to shape block faces to make a hole where it doesn't exist in the geometry

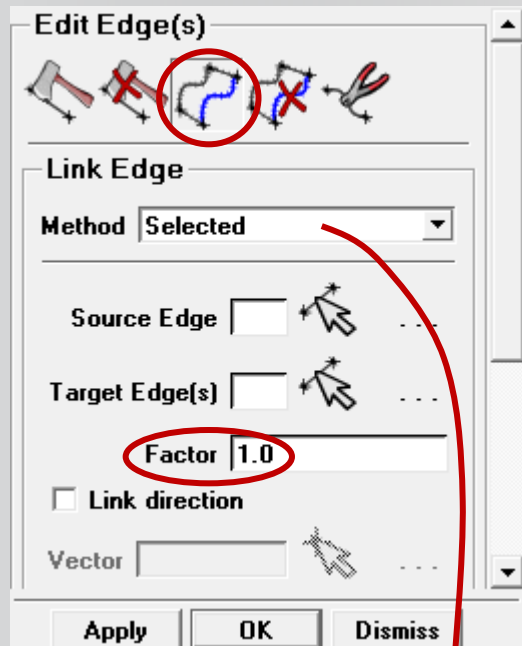


- Using split edges to make an improper structure fit the geometry



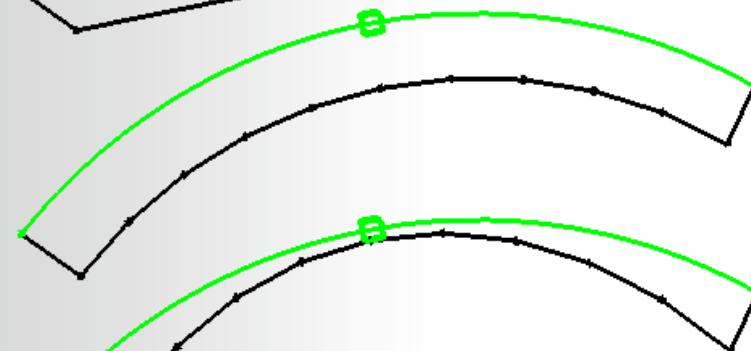
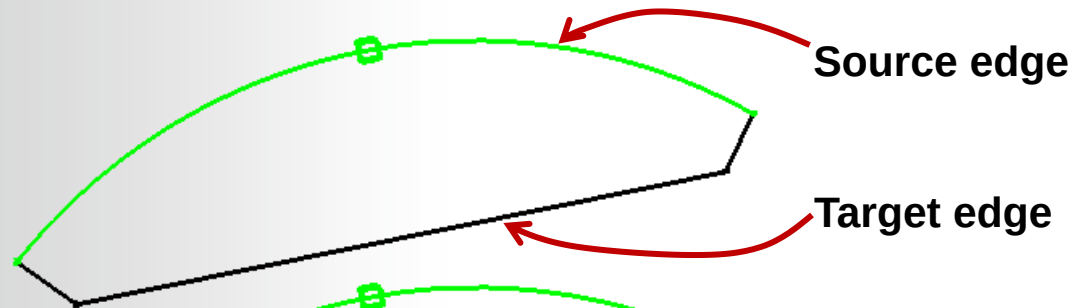
Shaping Edges – Link Edge

Blocking



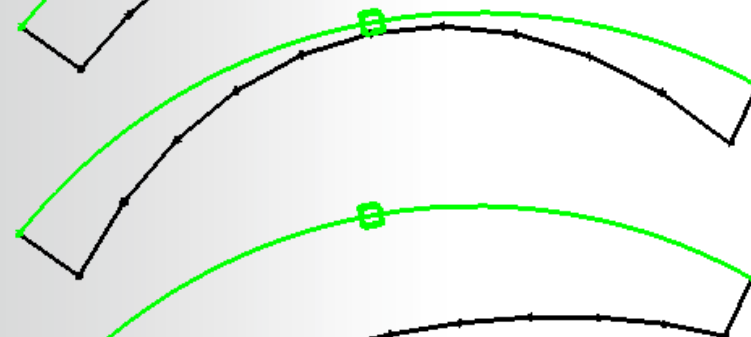
Selected
Interactive
In dimension

- Use one edge to control the shape of another
 - Select source edge then target edge(s)
 - Enter factor (higher number = greater curvature)



Factor = 0.9

Smaller curvature
radius requires factor
slightly smaller than 1



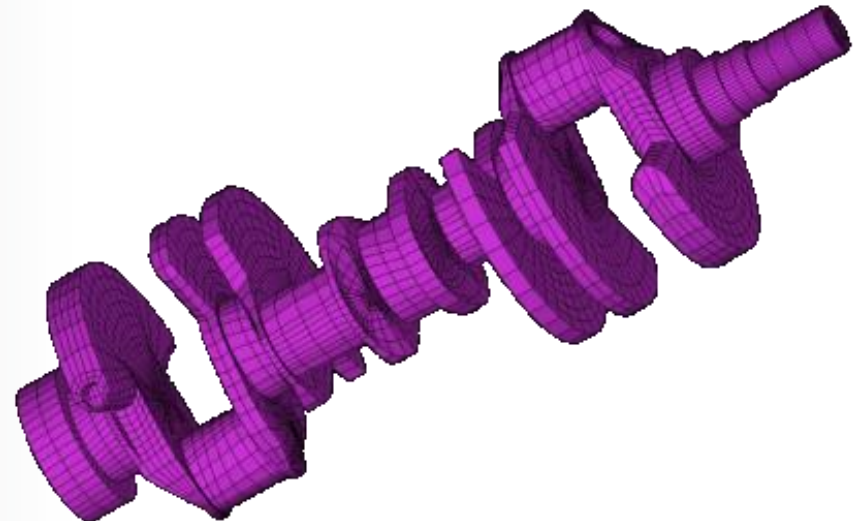
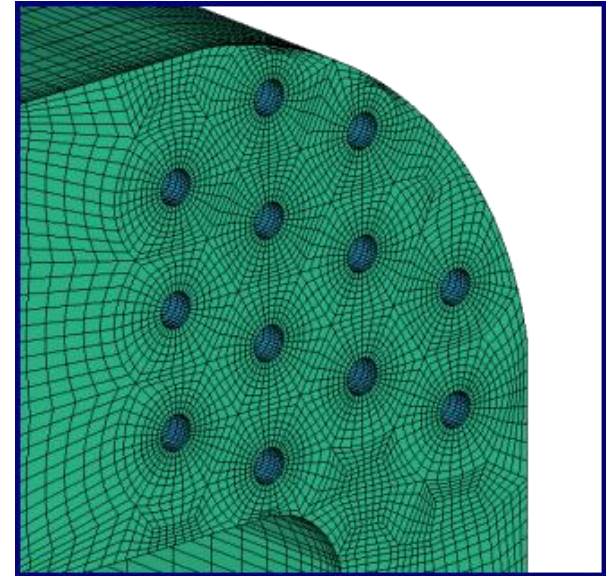
Factor = 1.3



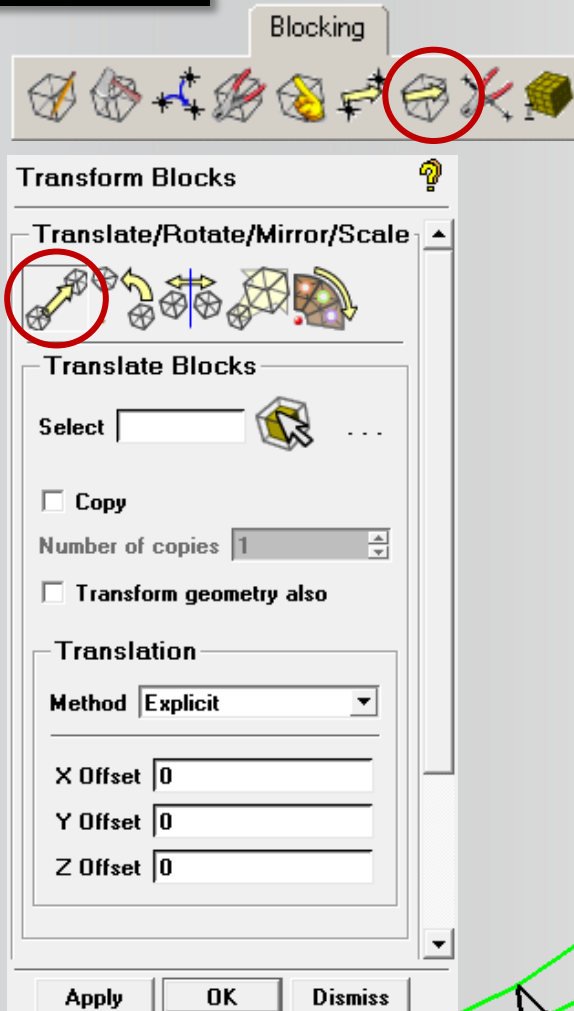
Factor = 0.5

Bottom-Up Meshing Methods

- Top-down is, generally, more robust
 - Preserves clean index scheme
- Bottom-up methods improve flexibility
 - *Transform Blocks, copy*
 - *Translate*
 - *Rotate*
 - *Mirror*
 - *Scale*
 - *2D to 3D* extrusion
 - *Translate*
 - *Rotate*
 - Block independently and merge
 - *Extrude face*
 - *Create block*
 - *Merging vertices can be bottom-up*



Transforming Blocks



- Simply transform selected blocks or make a copy and merge the transformed copy with the previous blocking

- Select blocks to transform
- Select **Method**

- **Translate**



- **Rotate**



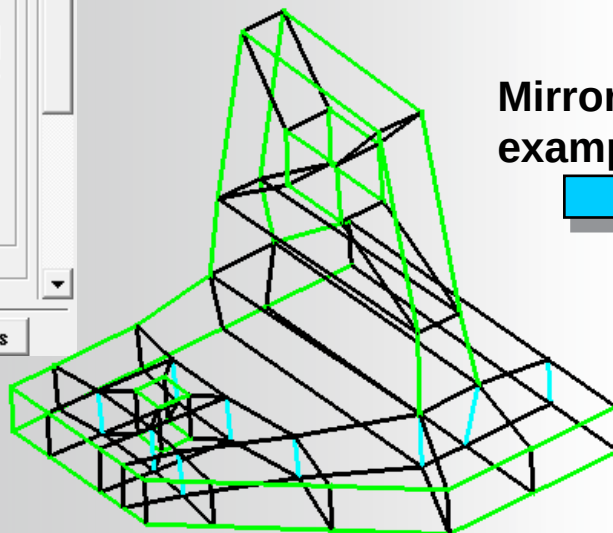
- **Mirror**



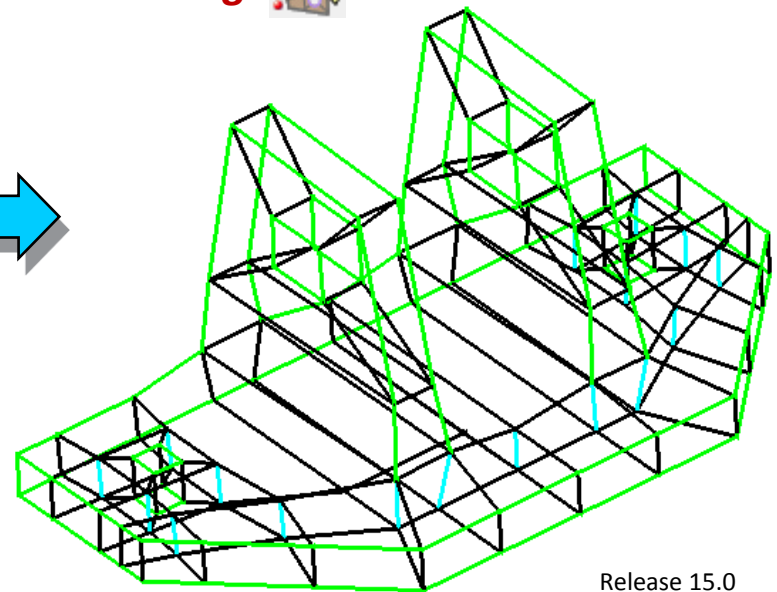
- **Scale**



- **Copy periodic blocking**

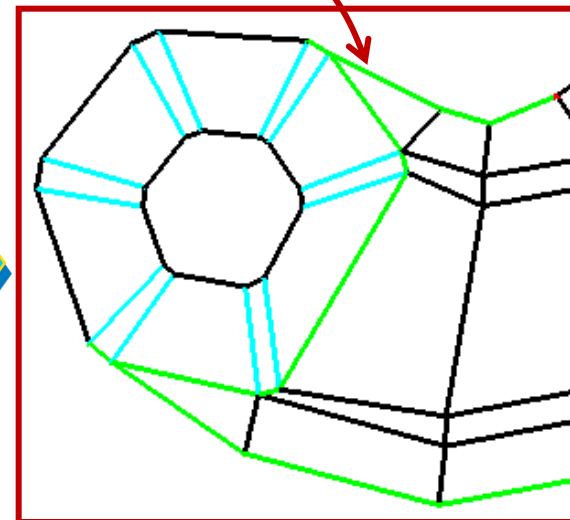
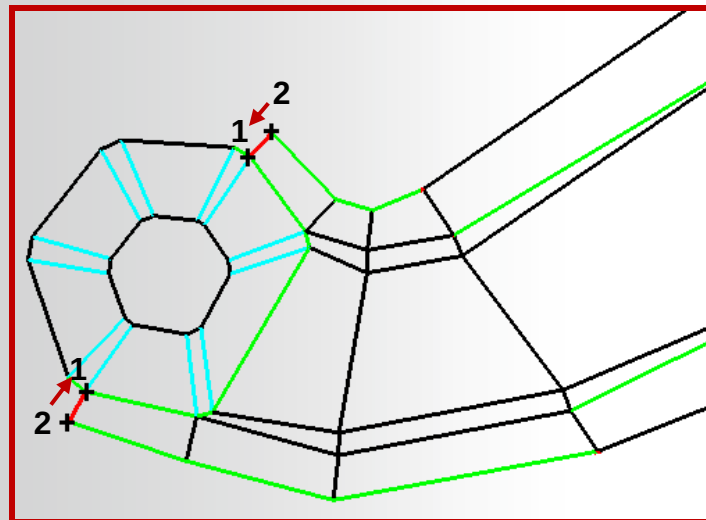
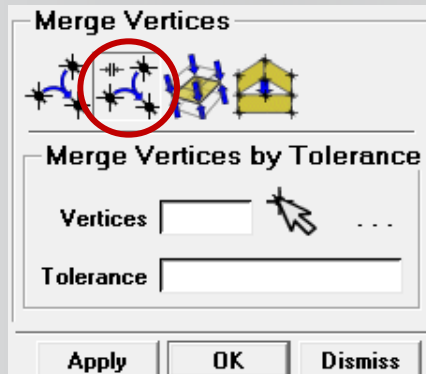
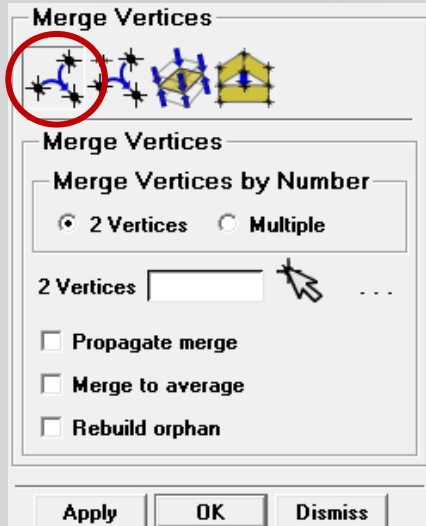


Mirror
example



Merge Vertices

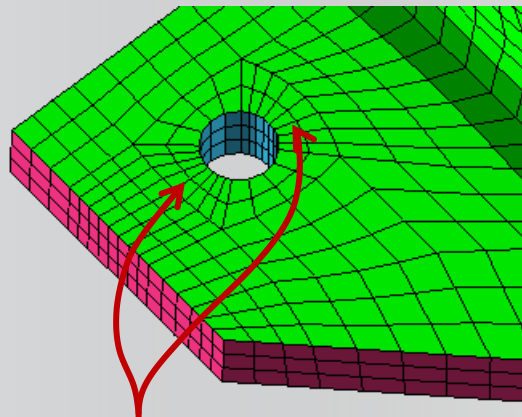
- One by one
- Multiple within tolerance
 - When merging individually, select two vertices at a time
 - With *Merge to average* off, the second vertex will merge to the first
 - With *Merge to average* on, both vertices merge to the middle of the two
 - Use to join separate topologies together
 - Use to make degenerate blocks



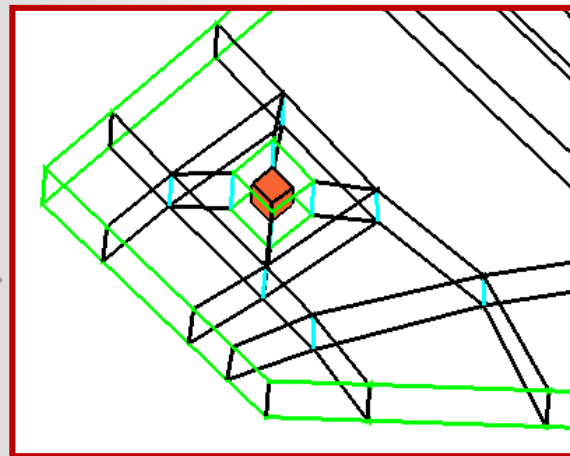
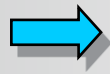
Delete Blocks – Permanently



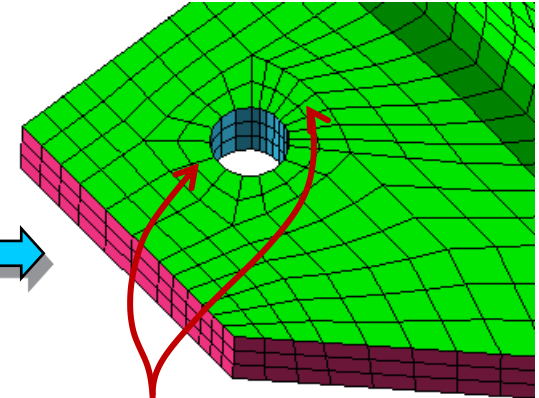
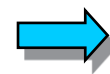
- Delete blocks will, by default, move blocks to the part VORFN, which is more stable than permanently deleting blocks (doesn't recompute indices)
- However, there are some situations where deleting permanently is useful
 - Deleting all of VORFN can serve as a repair tool in complex topologies (indices get reconfigured)
 - Deleting individual blocks will free up node connectivity across VORFN blocks



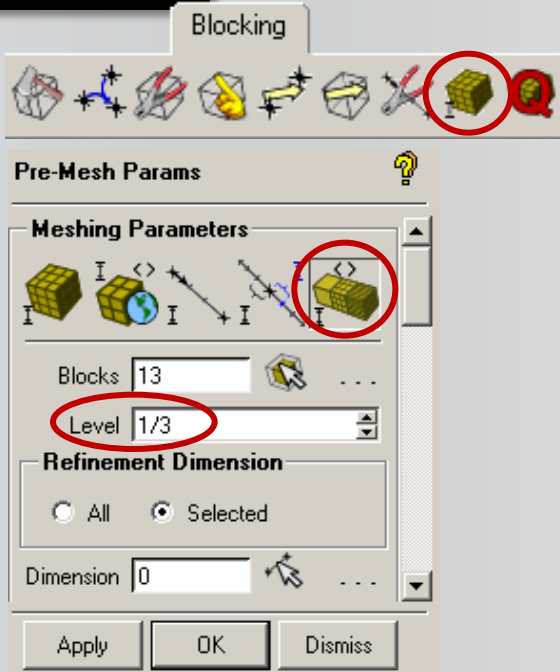
Equal number of nodes across hole



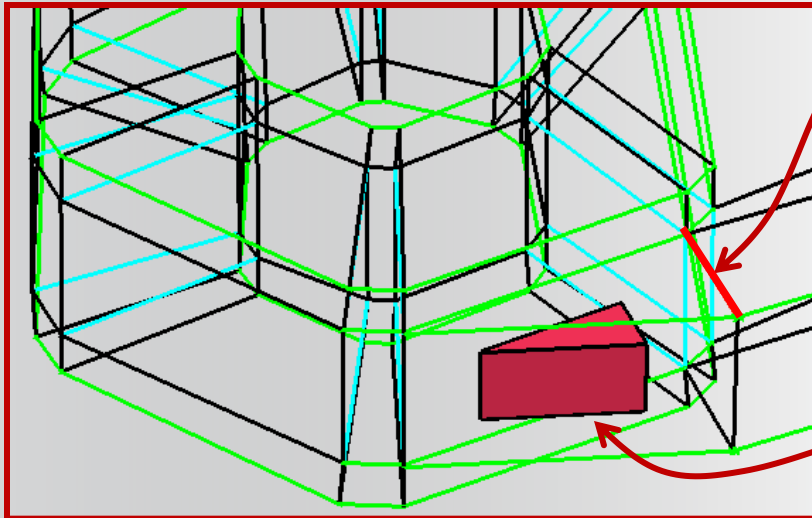
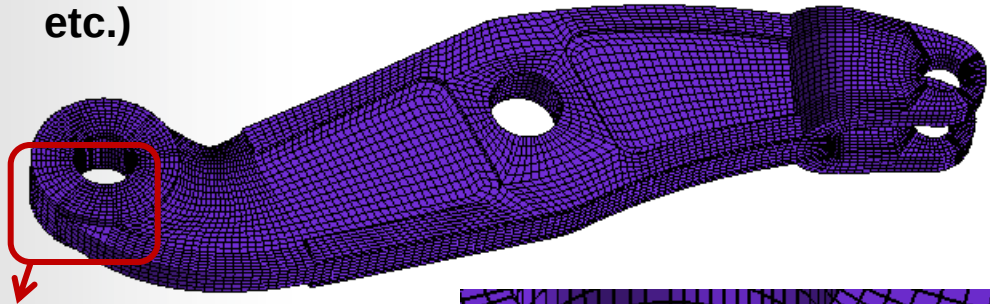
Delete block permanently



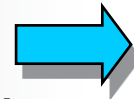
Number of nodes can be unequal



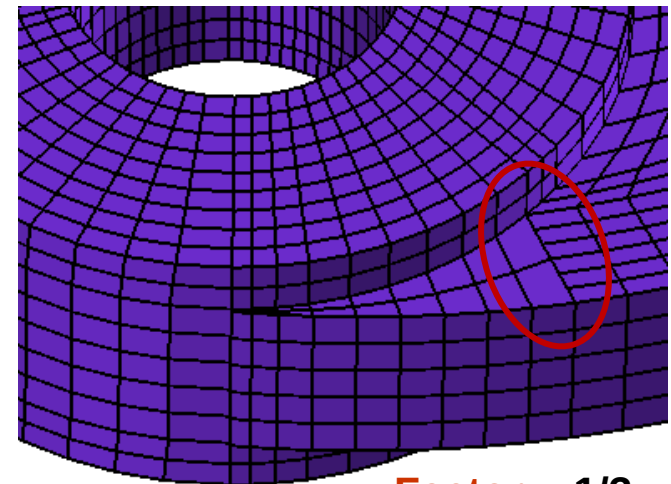
- Defines integer multipliers of elements across block interfaces
 - Can only be used with certain solvers
 - Refine: Factor > 1 (enter integer)
 - Coarsen: Factor < 1 (enter fraction – 1/2, 1/3, etc.)



Select
refinement
edge
direction or
select **All**



Select
block(s) to
refine within

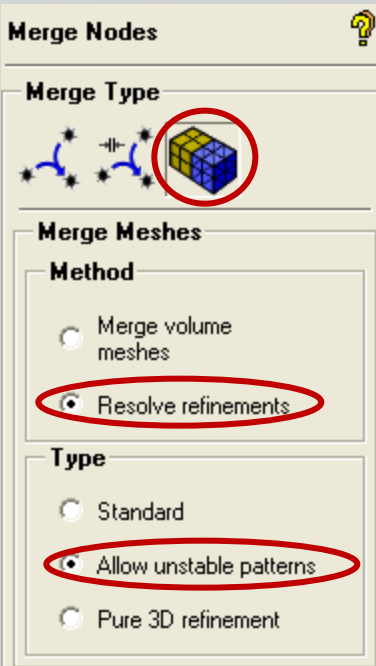


Factor = 1/3

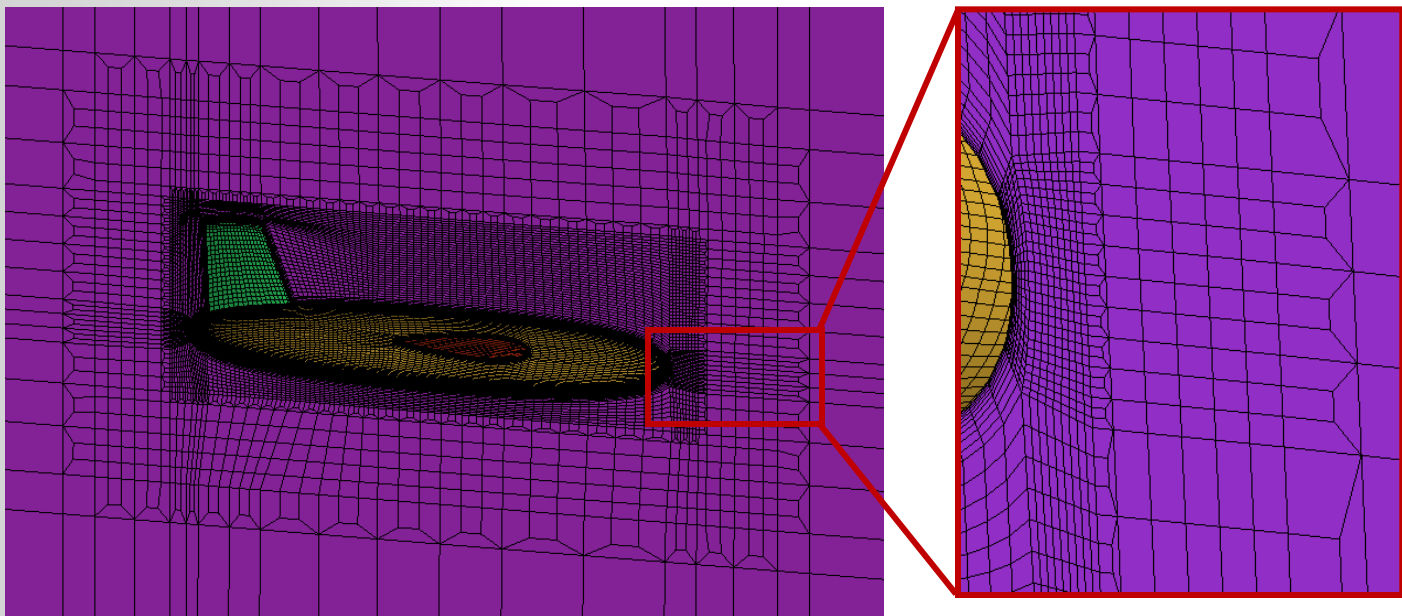
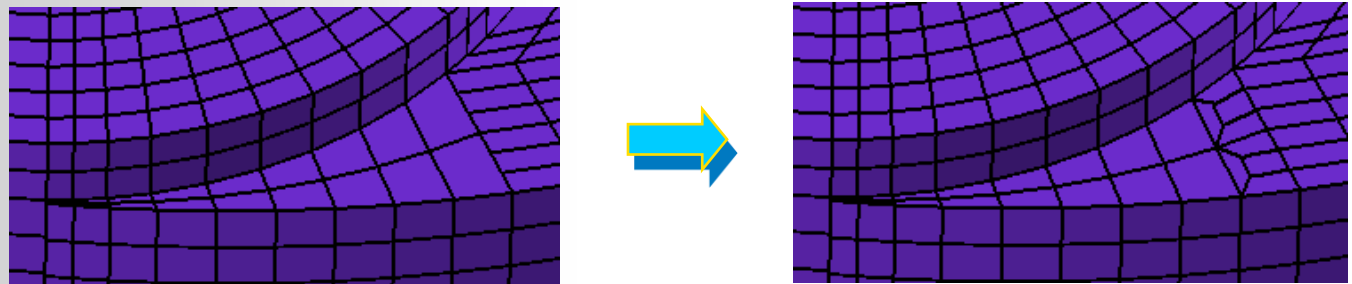
Resolve Refinements



- Creates 1-to-1 node connections for refinements done on the blocking
 - Only works on refinement ratio multiples of 3
 - Operates on the unstructured mesh only

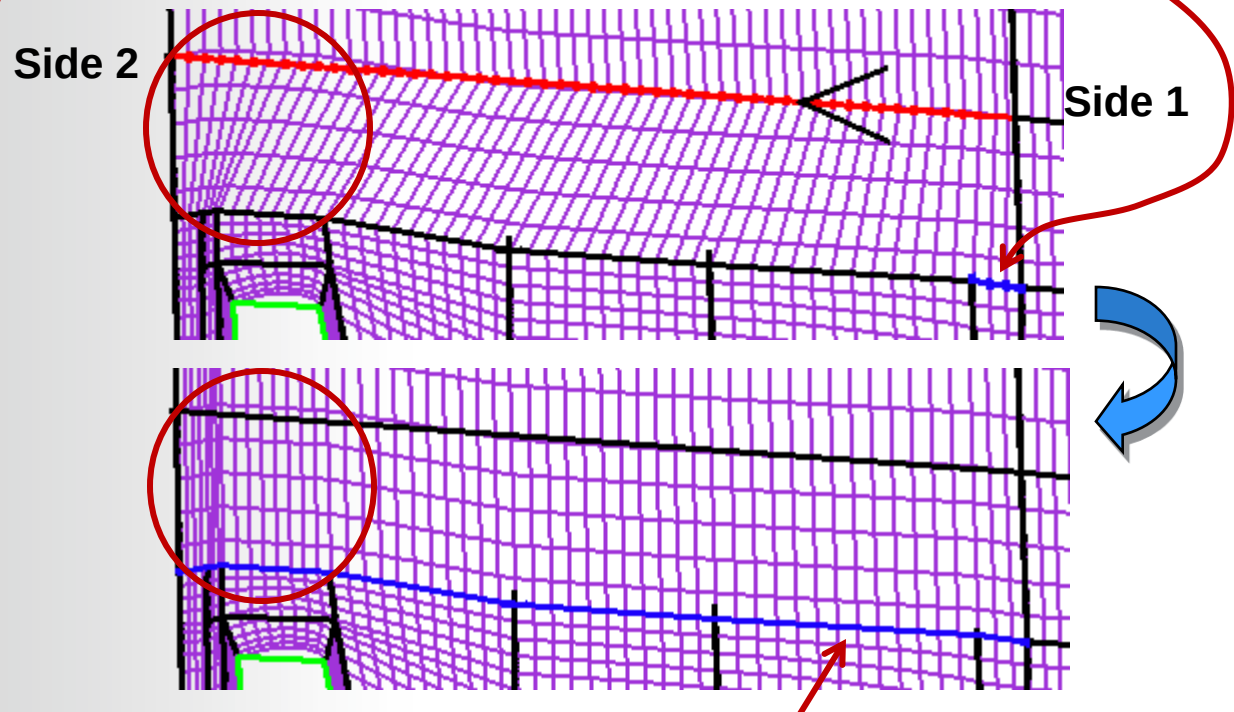
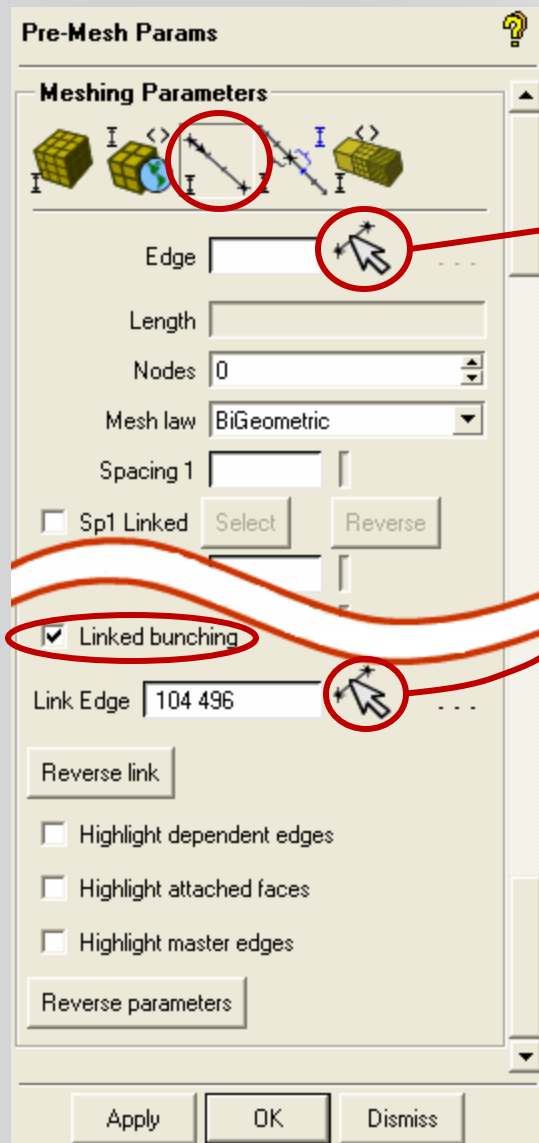


Multiple steps of refinement and resolving refinements can be done (3, 9, 27, 1/3, 1/9, 1/27, etc...)



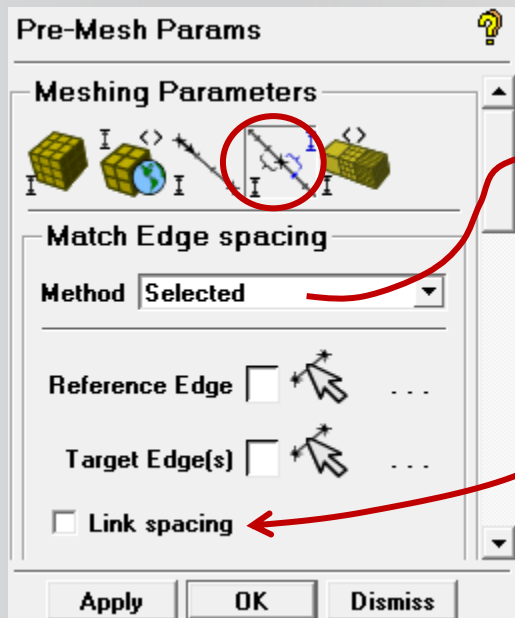
Edge Parameters – Linked Bunching

- Link node counts and distribution law to another edge
 - Can link to one **master** edge or a series of edges with the same end-bounds
 - Select the large edge first
 - Select the small edge on **side 1** when selecting the **Link Edge**



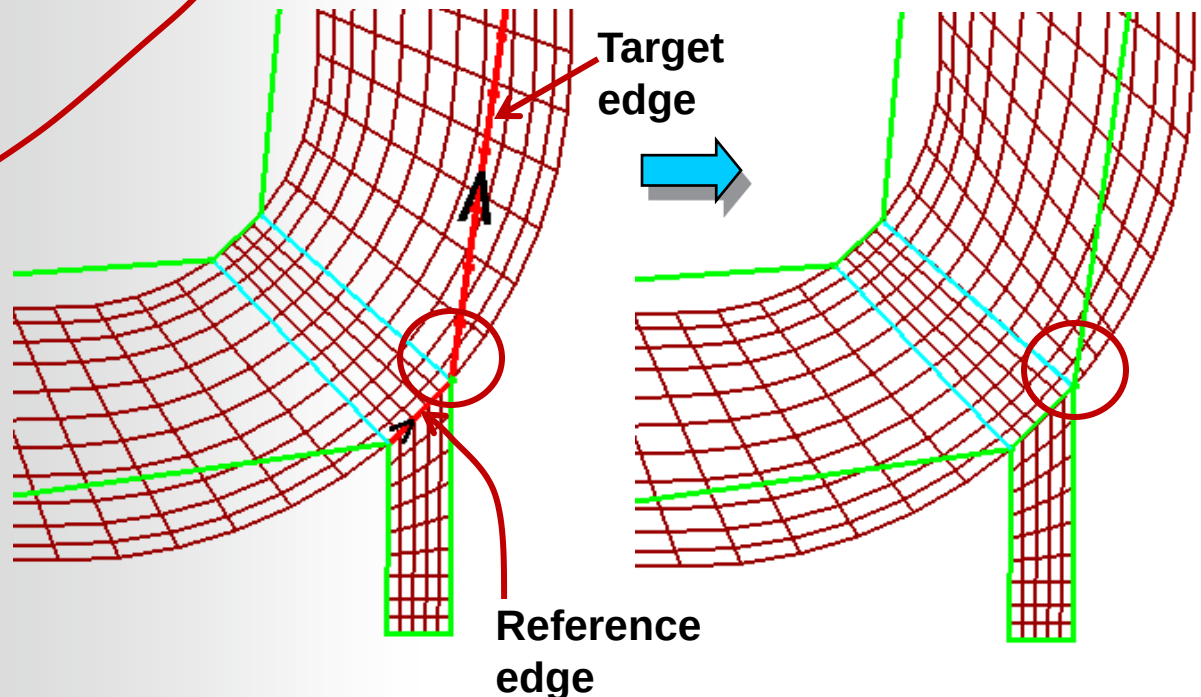
The long edge gets linked to all these shorter edges

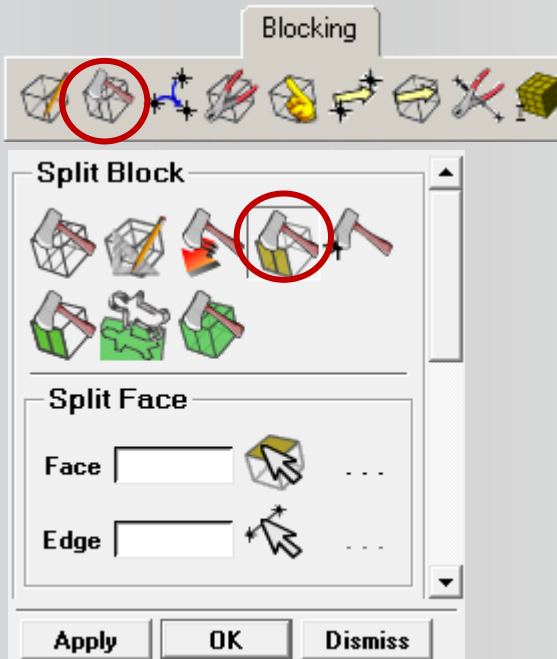
Match Edges



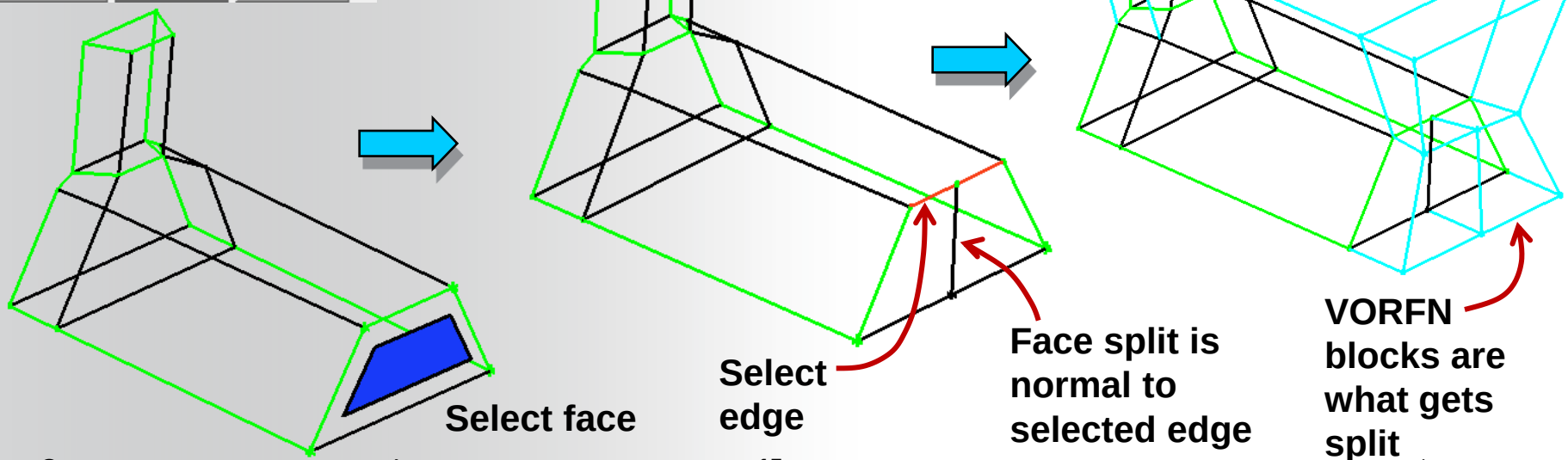
In this example, the side 1 node spacing of the target edge is set to the same node spacing as side 2 of the reference edge

- Matches the end spacing to another edge
 - Reference edge and target edge must meet at the same vertex
 - Can also link the spacing
 - The effect is usually only noticed when the target edge has an end spacing larger than the reference edge.

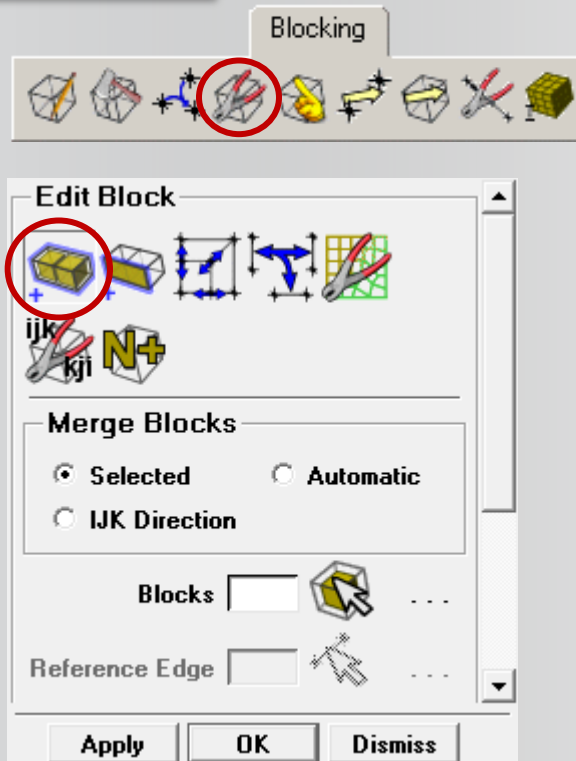




- **Split Face** is actually a split block operation
- **Split Face** splits the adjacent blocks in a non-active part (usually VORFN), and what is left visible is the end of the split on the visible faces
 - Select Face to split
 - Left click on edge and drag split, middle click to place
 - Split will be normal to the selected edge

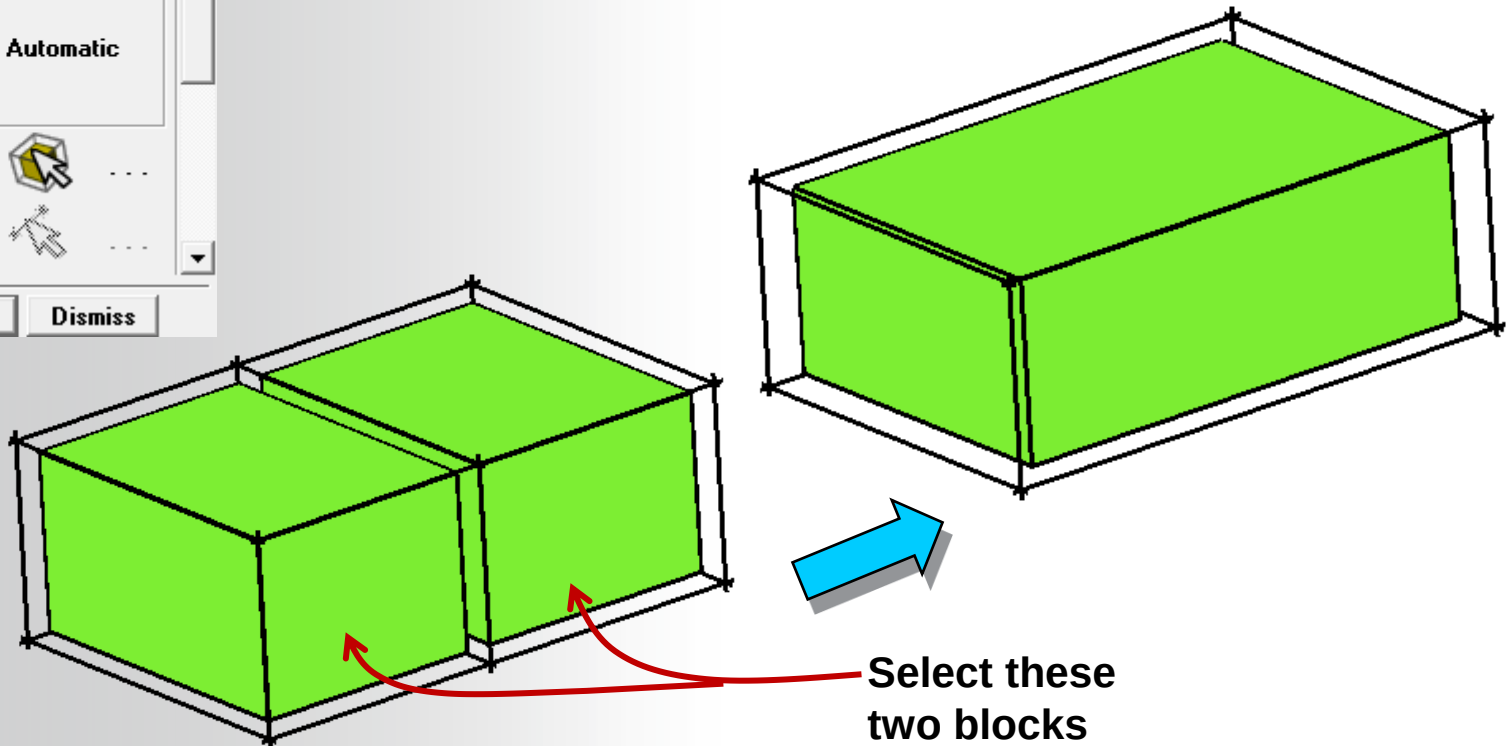


Merge Blocks



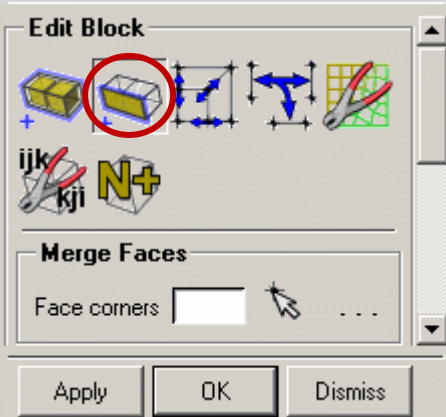
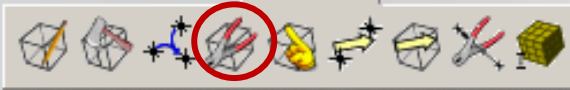
- **Merge blocks**

- Select blocks to merge, then middle click
- **Apply**
- You cannot merge blocks of different parts unless you first change them to the same part



Merge Faces

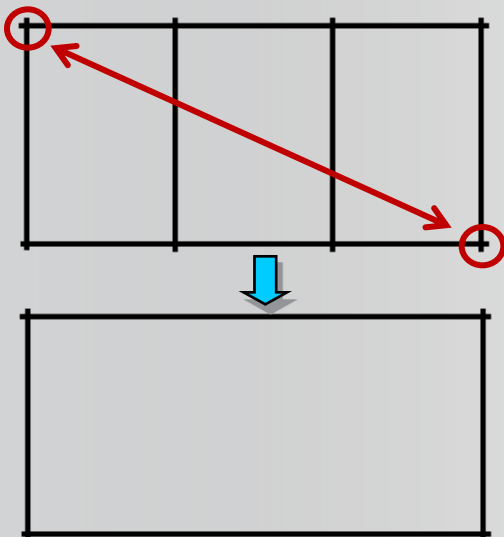
Blocking



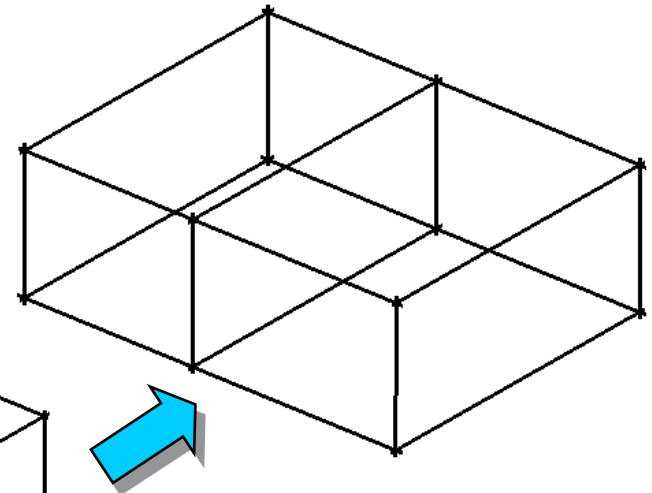
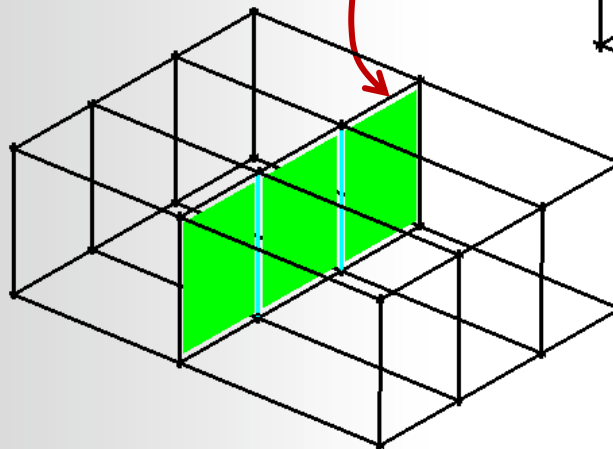
- **Merge Faces**

- Select 2 corners diagonally across faces to merge
- **Apply**
- You cannot select across O-grids because this is a different index direction
- This actually merges blocks on both sides of the selected faces

Select diagonally across vertices



Selected faces



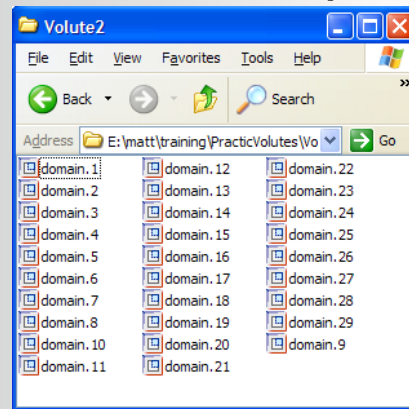
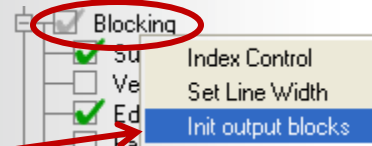
Merge Face
actually merges
blocks on both
sides of the
faces

Output Blocks

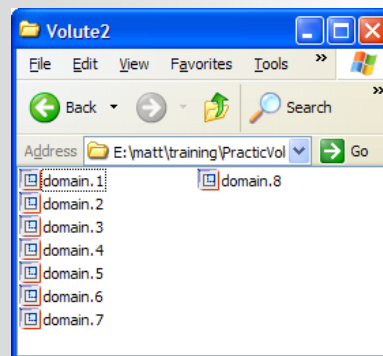
- Reduces number of blocks in a multiblock mesh, which reduces solver time

Three steps (in order)

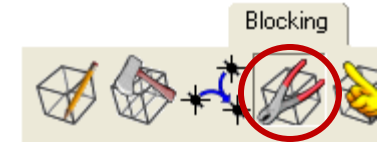
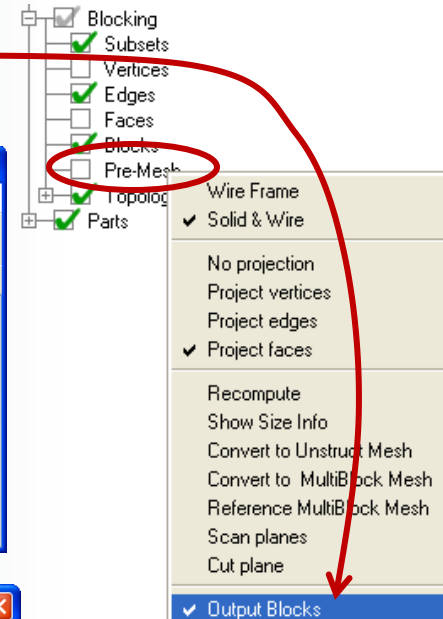
1. **Initialize** output blocks
2. Turn on **Output blocks**
3. **Merge** blocks (automatic or manual)



Before
29
blocks



After
8
blocks

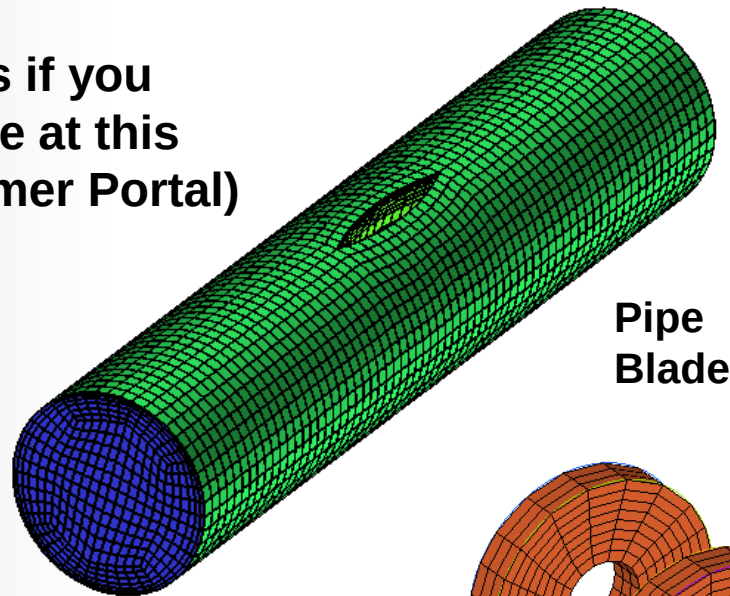


Initializing output blocks to the full blocking BEFORE merging blocks will prevent the mesh from being altered when merging blocks

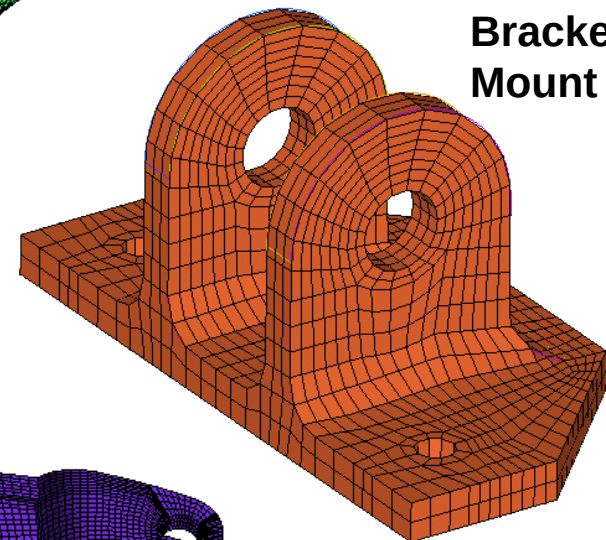
Output blocks can be toggled on and off between the merged blocking and the full blocking

Tutorials – Suggested Models

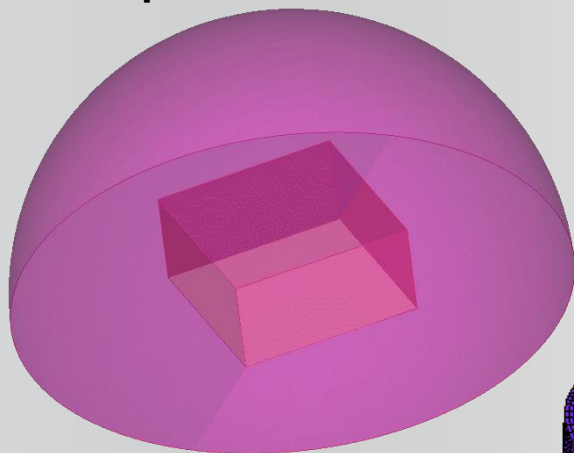
- Try any of these self-guided tutorials if you want a reasonable learning challenge at this point (available on the Ansys Customer Portal)
 - Pipe Blade (CFD) (collapse blocks)
 - Sphere Cube (CFD)
 - Bracket Mount (FEA)
 - create Y-blocks
 - Merge vertices to create O-grid



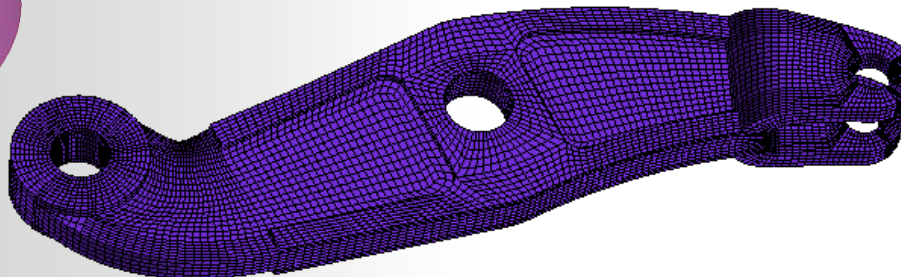
Pipe Blade



Bracket Mount



Sphere Cube



Lever (no self guided tutorial)