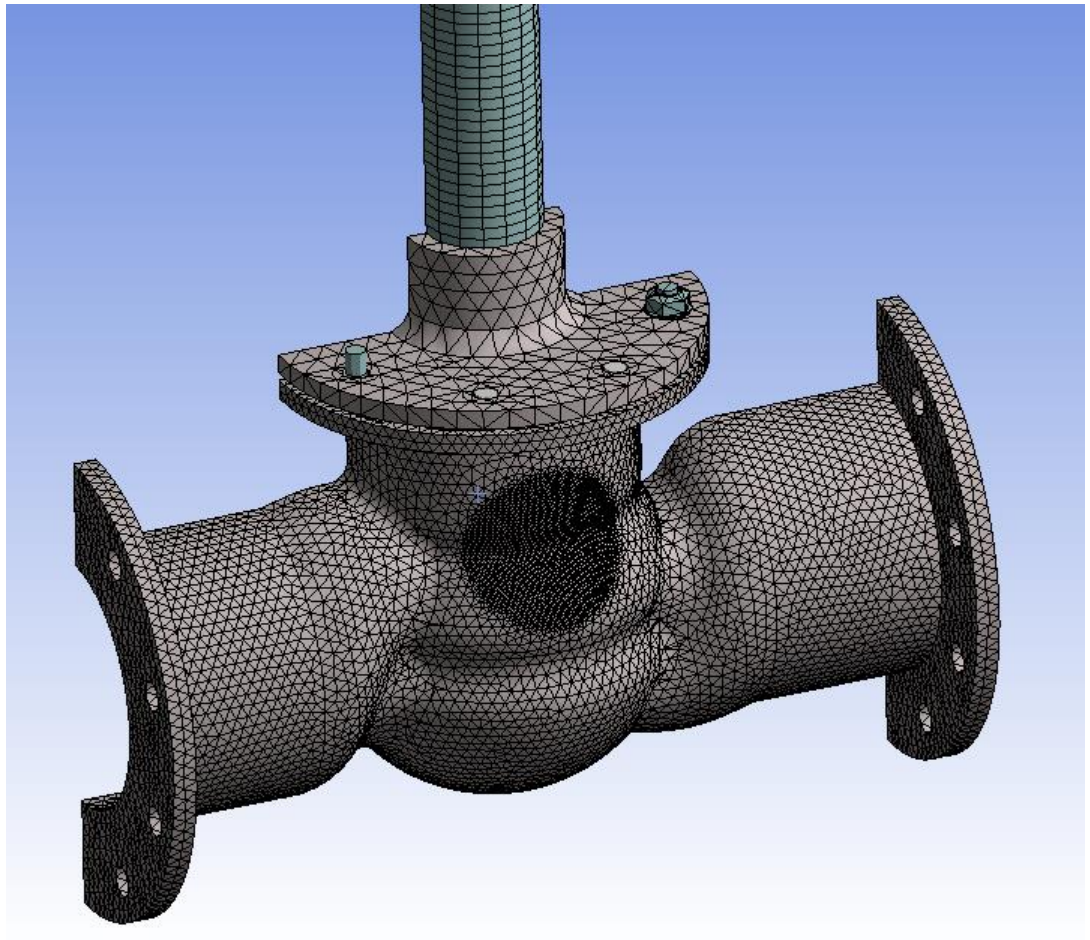
Ansys Mechanical Beyond the Basics

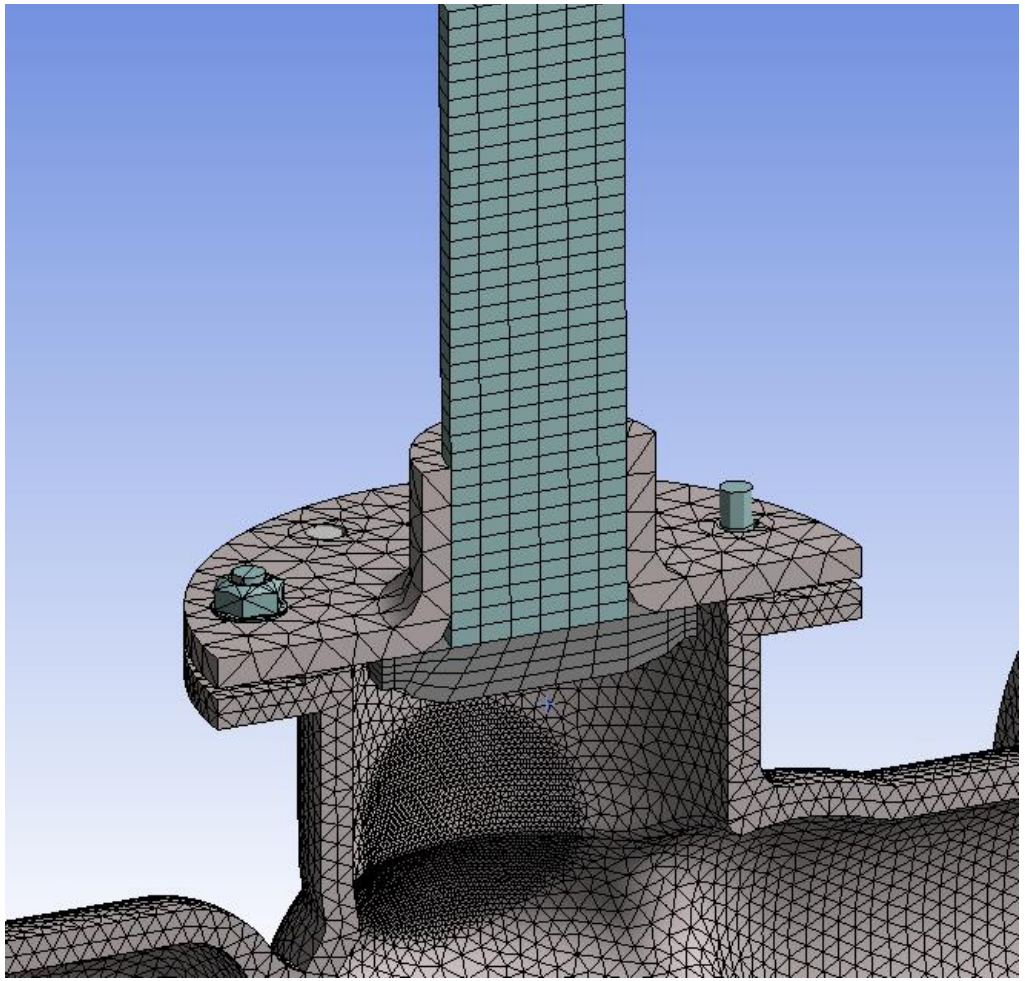
Module 04 Student Step-by-Step Guide: Enhanced Mesh Techniques

Release 2021 R2

Step-by-Step Guide 04: Enhanced Mesh Techniques

Use this guide to repeat the steps the instructor demonstrated within this module.



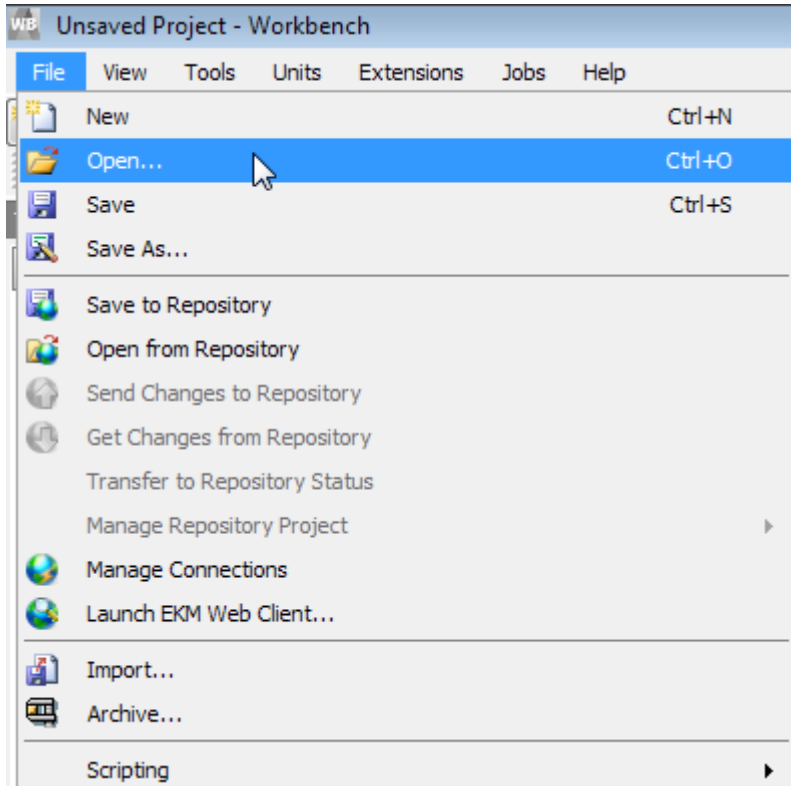


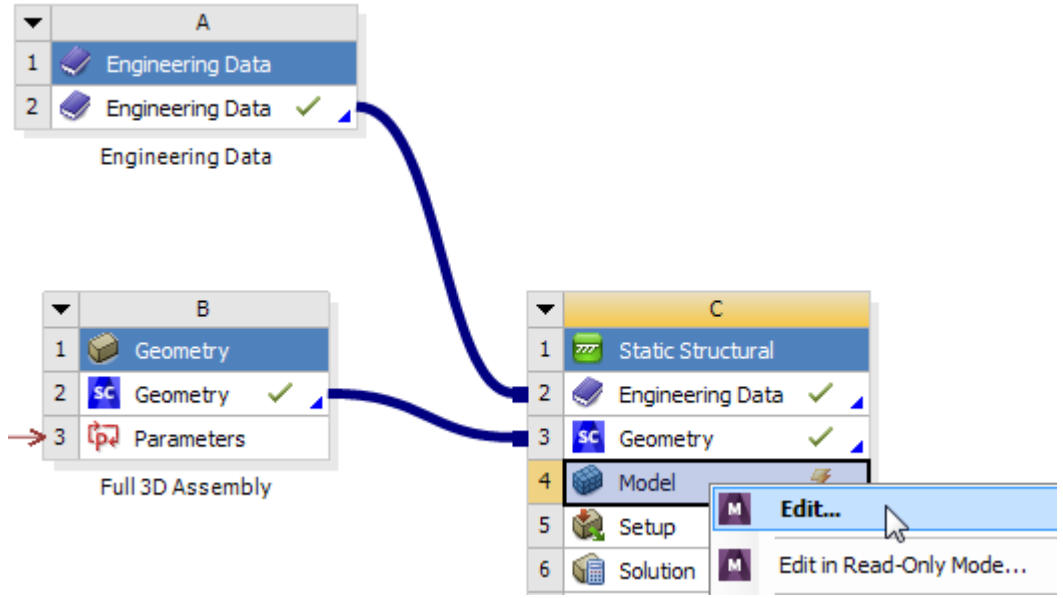
Step-by-Step Guide 04: Enhanced Mesh Techniques

- Open **Archive:**

"Globe_Valve_SS04_Start.wbpz"

- Open Mechanical





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Review the existing Mesh settings:

- **Mesh → Sizing →** Use Adaptive Sizing **→ No**
- **Mesh →** Defaults **→ Element Size → 6.35mm**
- **Mesh → Body Sizing → Valve Body → Element Size → 3.175mm**

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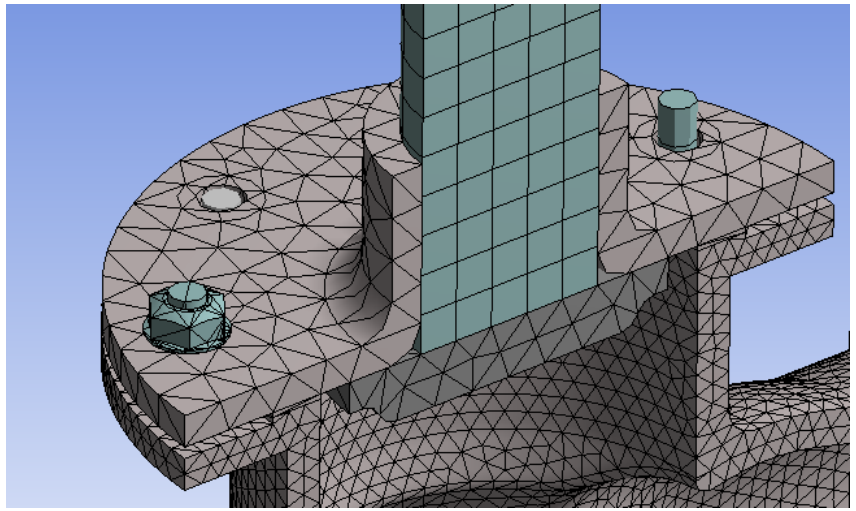
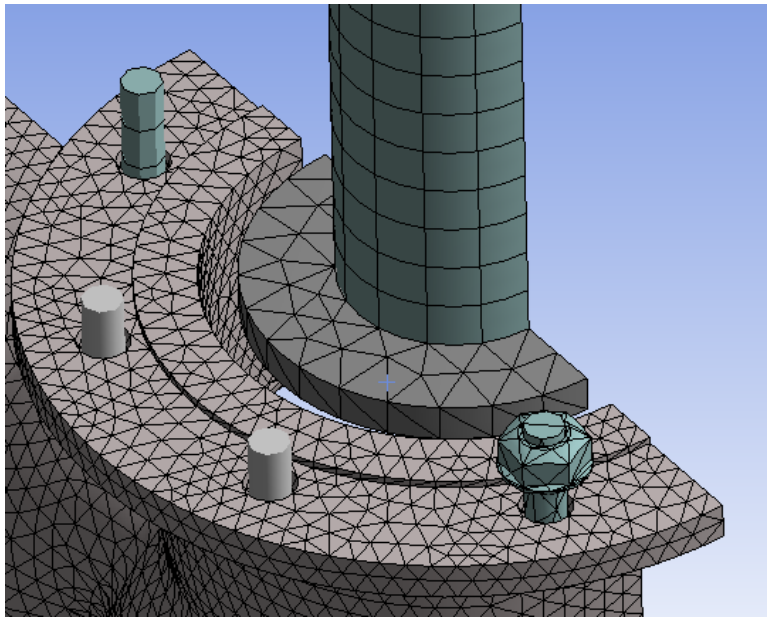
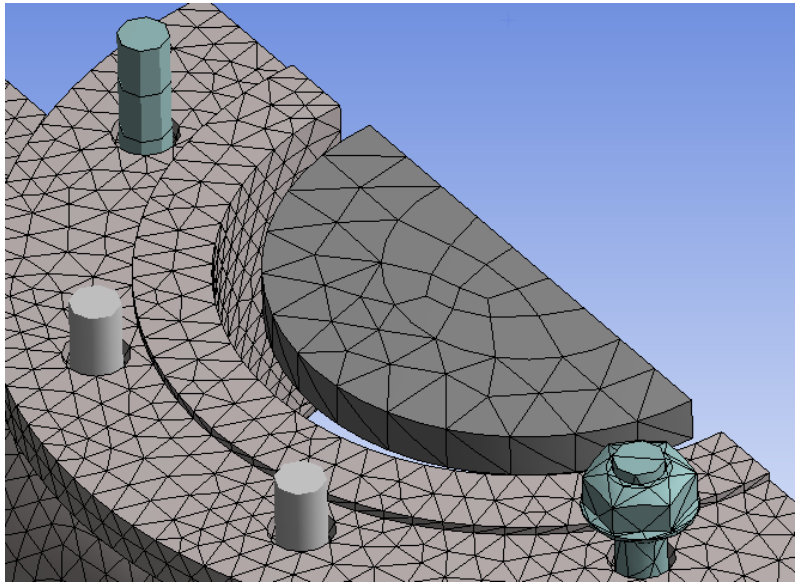
Generate the mesh on the model using these existing mesh settings, and note the mesh connectivity between the Valve Rod and Valve Seal bodies resulting from the Shared Topology Valve Assy part:

- **RMB – Mesh → Generate Mesh**
- Hide Flange and Valve Rod as needed







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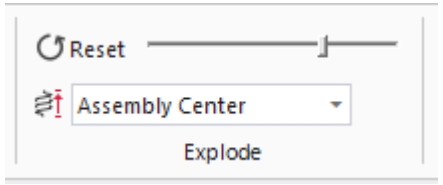
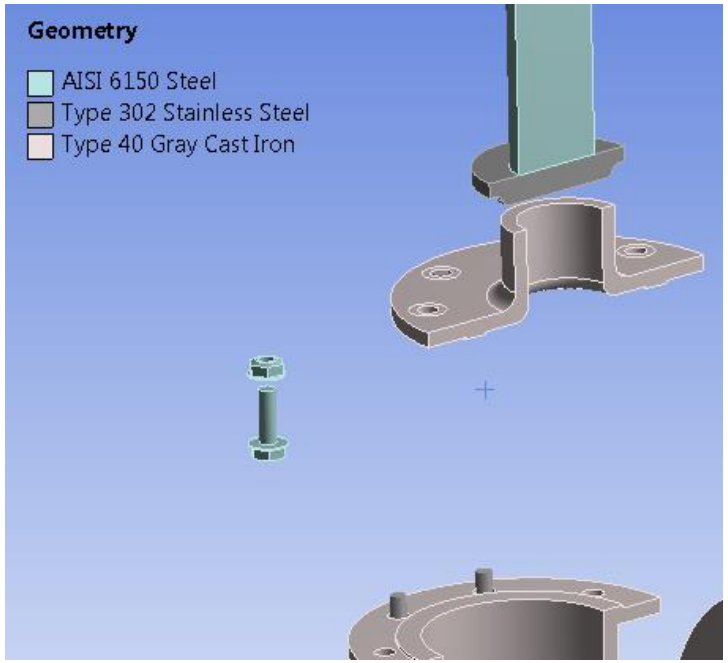
Confirm Sharing of Topology on Valve Assy part by using the Explode Tool; note the Valve Rod and Valve Seal bodies explode as 1 connected part:

- RMB - Graphics Window → **Show All Bodies**
- Select **Geometry** Branch
- **Explode** Assembly using **Explode Slider** in the Display tab





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View Pyramid Elements at Shared Topology interface:

- Details of Mesh → **Quality → Mesh Metric → Element Quality**
- Select **Controls** in Mesh Metric window
- De-activate **Tet10** and **Hex 20** Elements
- Set Y-Axis Max → 10
- Close “X” the Controls dialog

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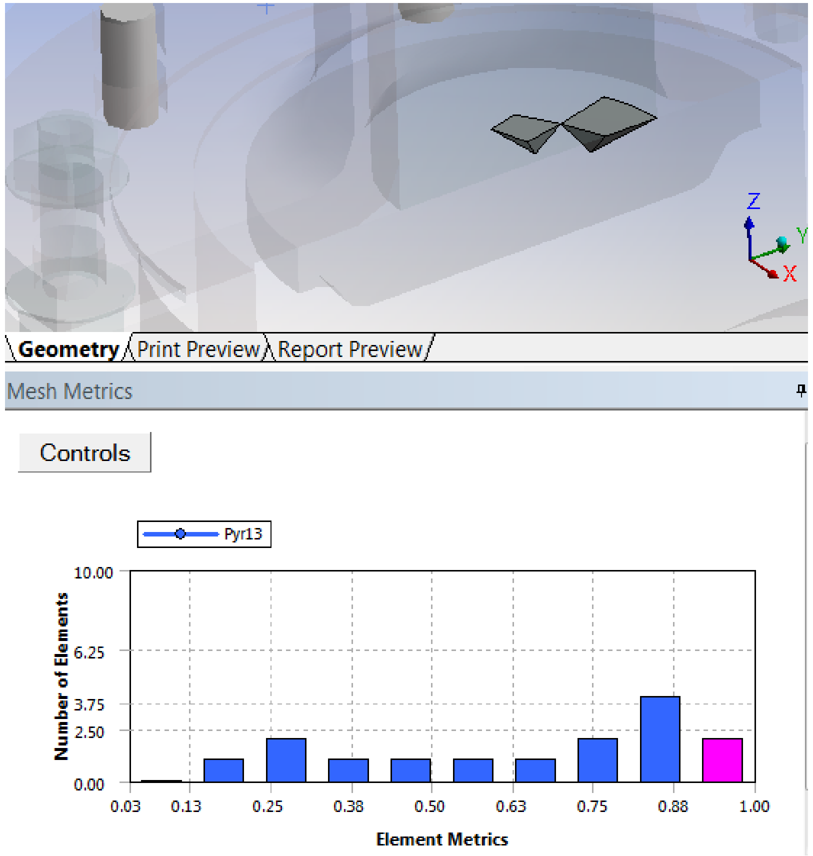
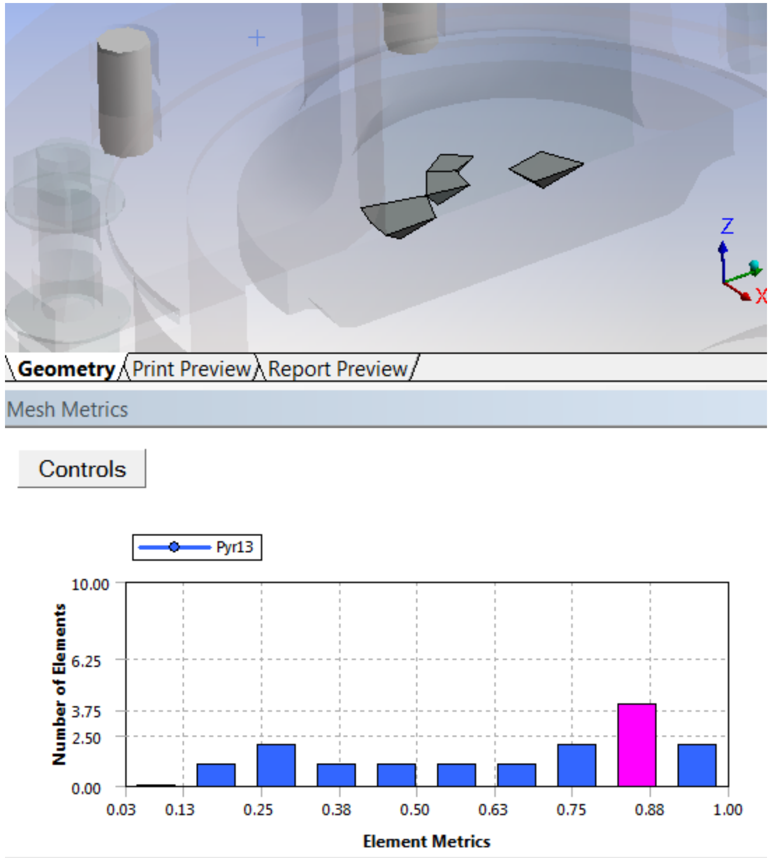
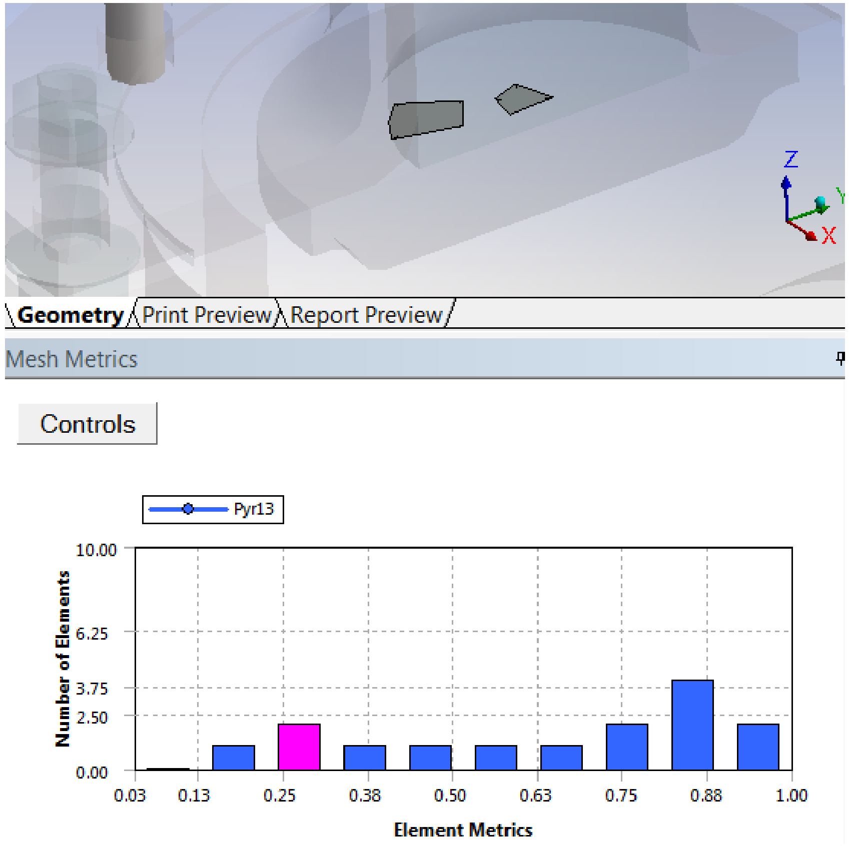
View Pyramid Elements at Shared Topology interface:

- Select individual bars on bar graph to display only elements of that Quality Measure
- Set **Mesh Metric → None** when finished







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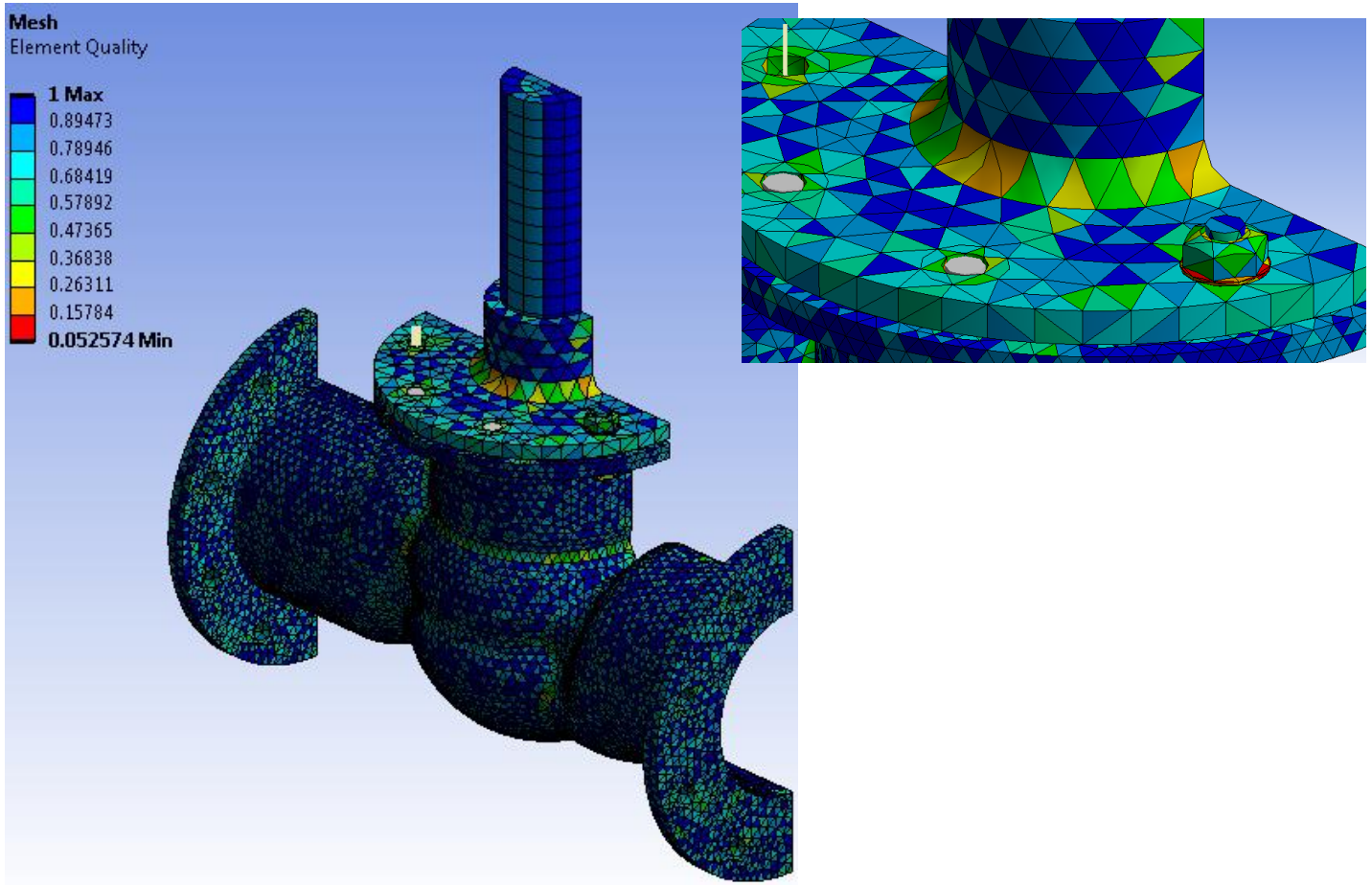
Tighten Mesh Quality tolerances, remesh, and view Element Quality as contours

- **Mesh → Quality → Error Limits → Aggressive Mechanical**
- **Generate Mesh**
- **Mesh → Display → Display Style → Element Quality**



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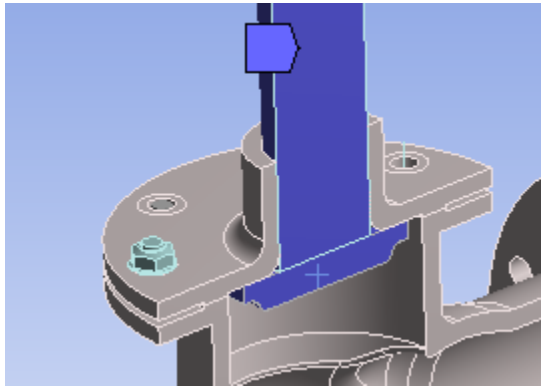
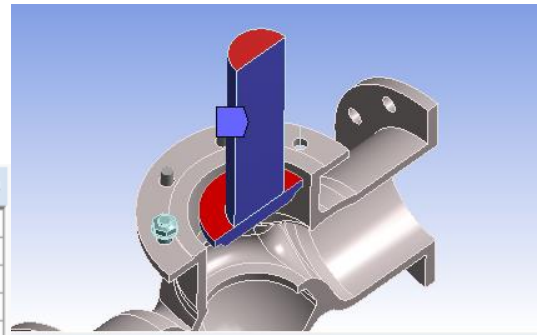
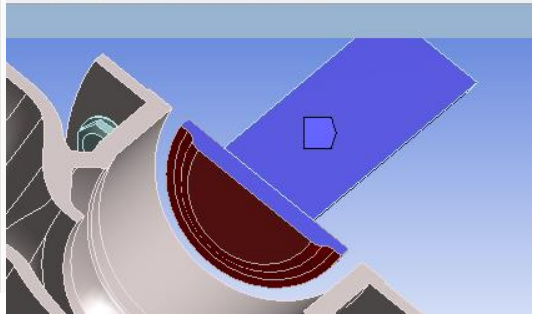
Use Multizone Meshing on Valve Assy to arrive at more efficient mesh on this Shared Topology Body



- **RMB – Mesh → Insert → Method**
- Scope to **Valve Rod** and **Valve Seal** bodies
- Details of **Automatic Method → Method → Multizone ; Src/Trg Selection → Manual Source ;** Select 6 surfaces of **Valve Assy** Body in Sweep direction **; Element Order → Linear ; Sweep Element Size → 3.0 mm**





Details of "MultiZone" - Method

Scope	
Scoping Method	Geometry Selection
Geometry	2 Bodies
Definition	
Suppressed	No
Method	MultiZone
Mapped Mesh Type	Hexa
Surface Mesh Method	Program Controlled
Free Mesh Type	Not Allowed
Element Order	Linear
Src/Trg Selection	Manual Source
Source Scoping Method	Geometry Selection
Source	6 Faces
Sweep Size Behavior	Sweep Element Size
Sweep Element Size	3.0 mm

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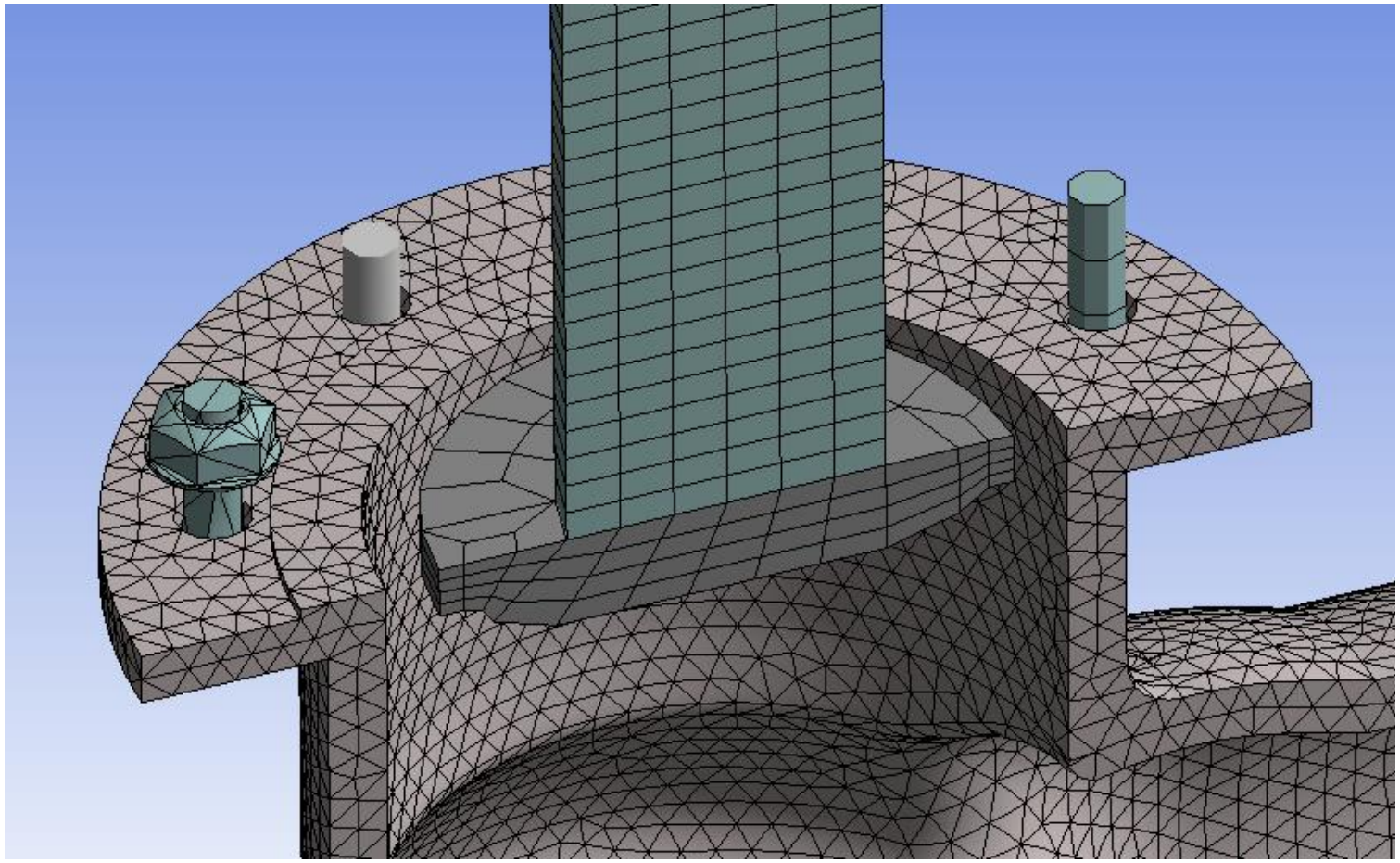
- Use Multizone Meshing on Valve Assy to arrive at more efficient mesh on this Shared Topology Body
- **Generate Mesh**



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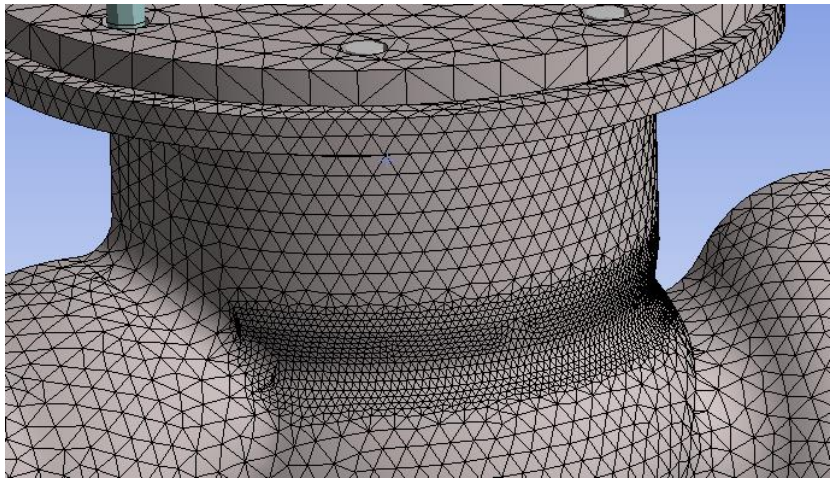
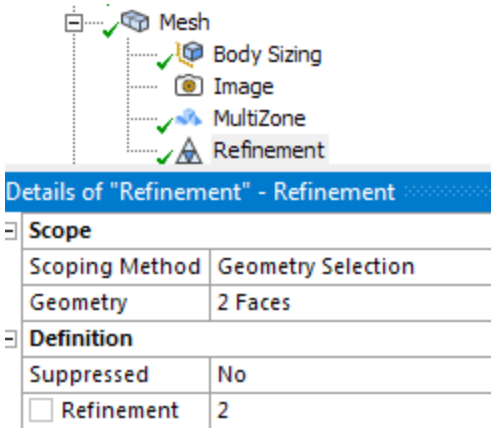
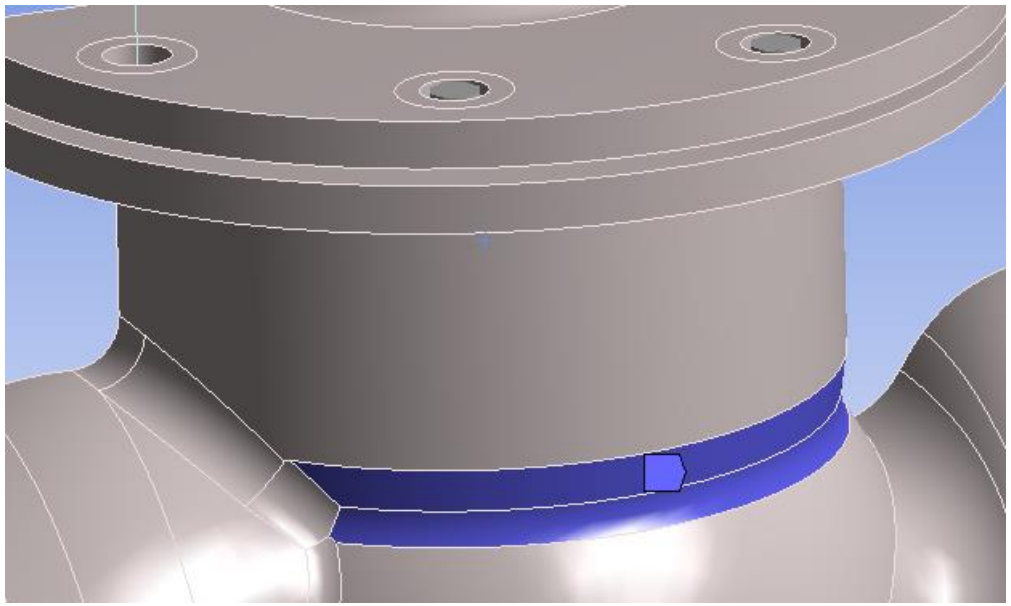
Use Mesh Refinement in critical stress region of Valve Body part

- **RMB – Mesh → Insert → Refinement**
- Select two surfaces on Valve Body part
- Set **Refinement** level → 2
- **Generate Mesh**







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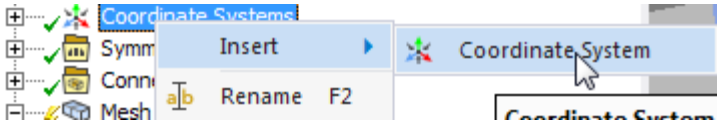
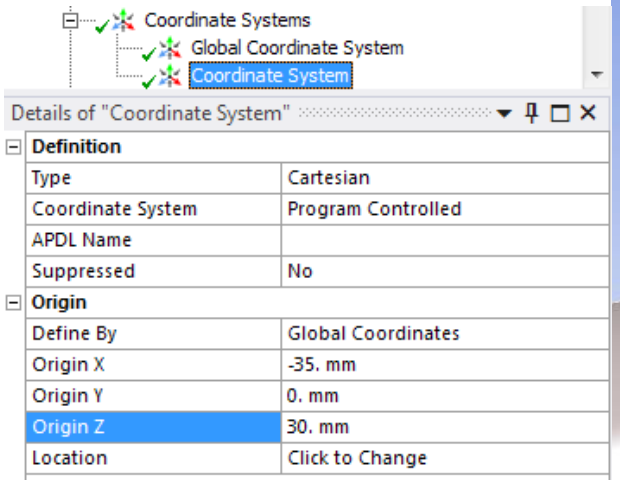
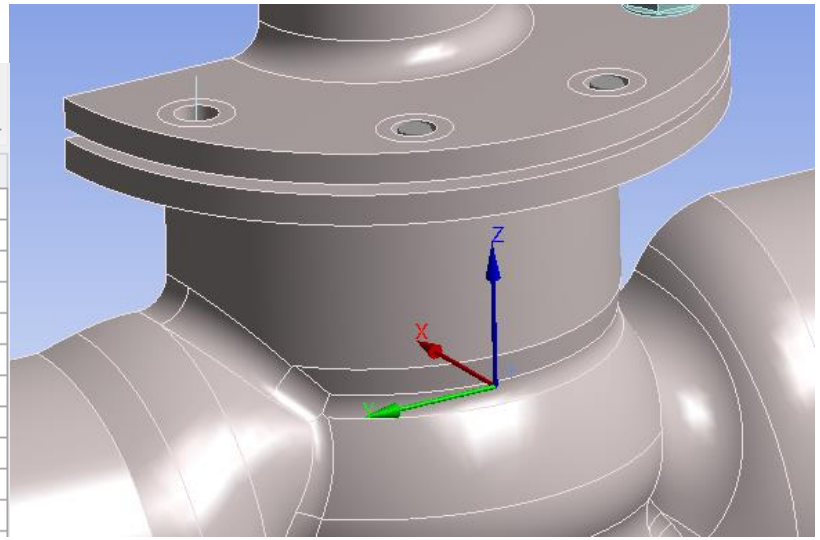
Delete Refinement and use Sphere of Influence Mesh Control to achieve refinement in Valve Body; create local Coordinate System to use as Sphere Center

- **RMB – Refinement → Delete**
- **Select Coordinate Systems**
- **RMB – Coordinate Systems → Insert → Coordinate System**
- Details of **Coordinate System – Origin → Define By → Global Coordinates**
- **Origin X → -35 mm**
- **Origin Z → 30 mm**



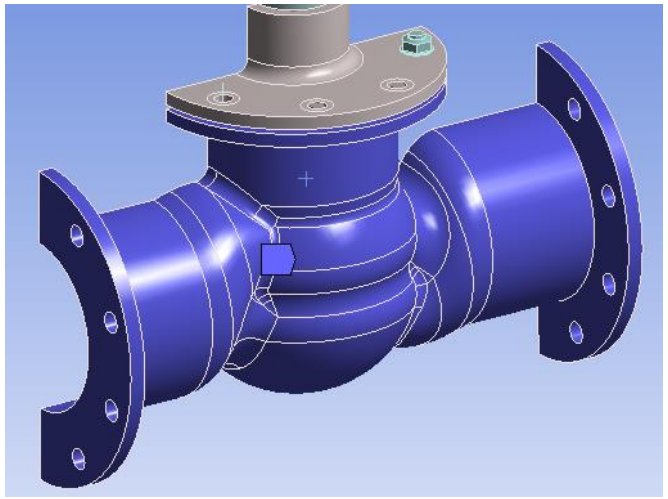


Definition	
Type	Cartesian
Coordinate System	Program Controlled
APDL Name	
Suppressed	No
Origin	
Define By	Global Coordinates
Origin X	-35. mm
Origin Y	0. mm
Origin Z	30. mm
Location	Click to Change

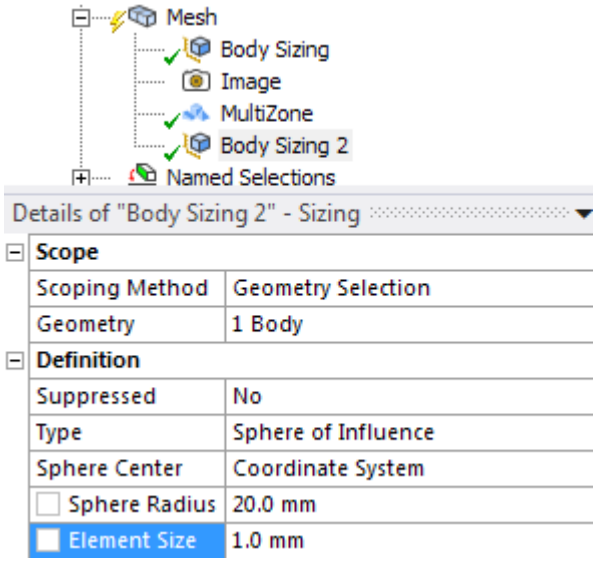


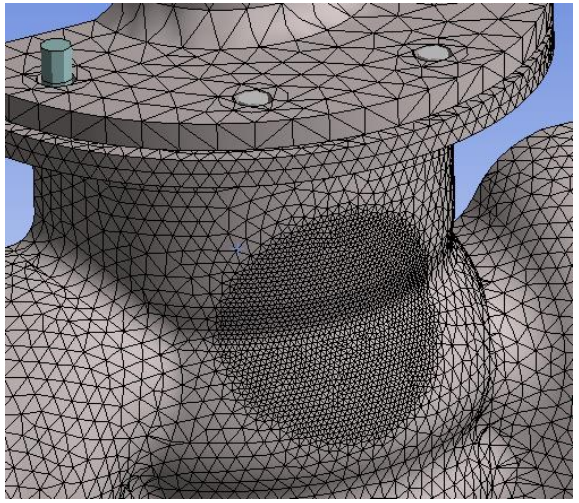
Step-by-Step Guide 04: Enhanced Mesh Techniques

Delete Refinement and use Sphere of Influence Mesh Control to achieve refinement in Valve Body; Use Coordinate System to Define Sphere Center



- **RMB – Mesh → Insert → Sizing**; Scope to **Valve Body** part
- Details of **Body Sizing 2 → Type → Sphere of Influence**
- **Sphere Center → Coordinate System**
- **Sphere Radius → 20 mm**
- **Element Size → 1 mm**
- **Generate Mesh**





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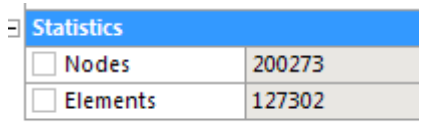
Interrogate Mesh for purpose of determining node count and approximating Degrees of Freedom and resulting memory requirements for the solution

- Details of **Mesh → Statistics → Nodes**
- Node count = ~ 200,000
- 3 DOF per node → 600,000 DOF
- 10-20 GB RAM / 1 M DOF
- This model will require a minimum of 6 GB RAM



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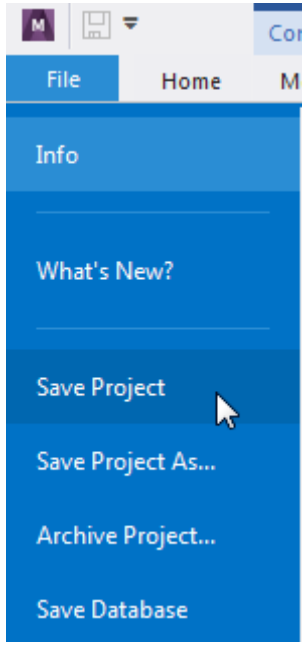
- **Save Project** for use later if desired.

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