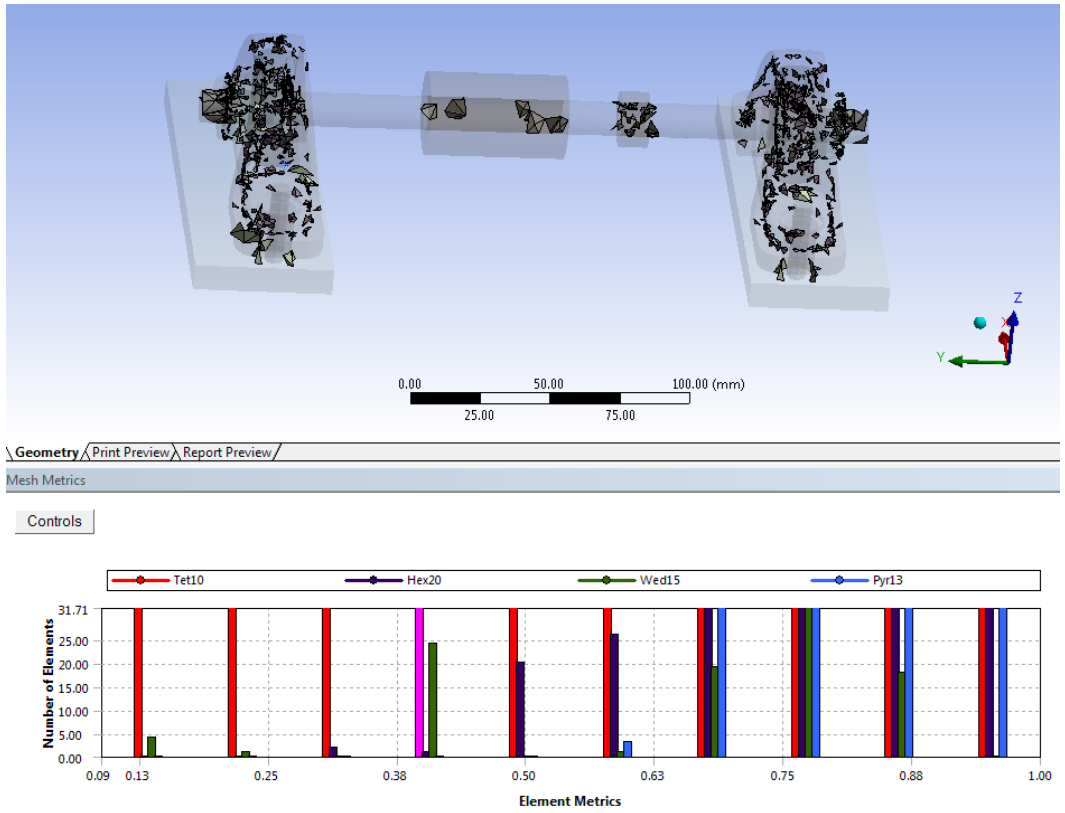
Ansys Mechanical Beyond the Basics

Module 04 Workshop: Enhanced Mesh Techniques

Release 2021 R2

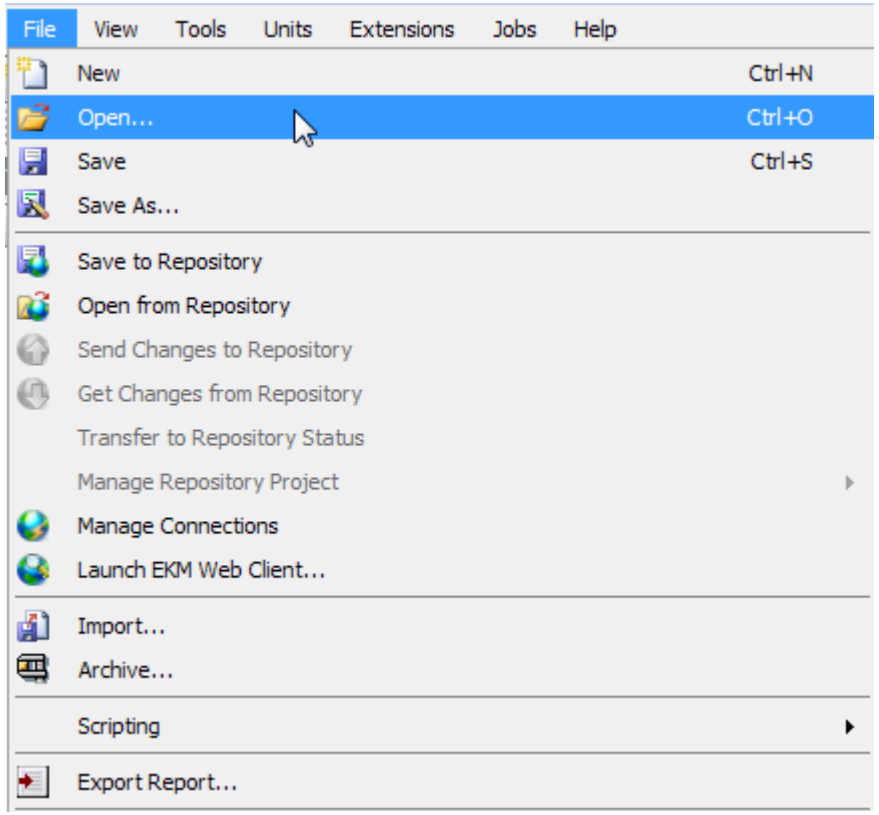
Workshop 04: Enhanced Mesh Techniques

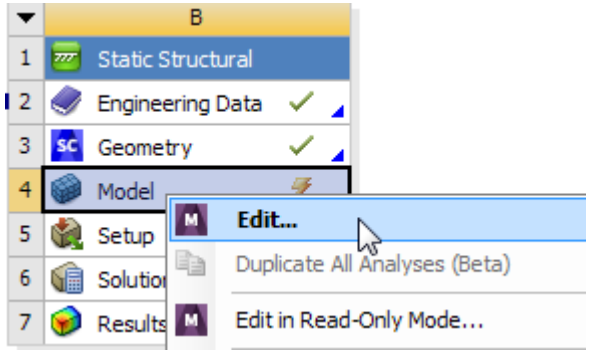
Use this guide to work on the Journal Bearing model.



Workshop 04: Enhanced Mesh Techniques

- **Open Archive:** “Shaft_Bearings_WS04_Start.wbpz”
- **Open** Mechanical





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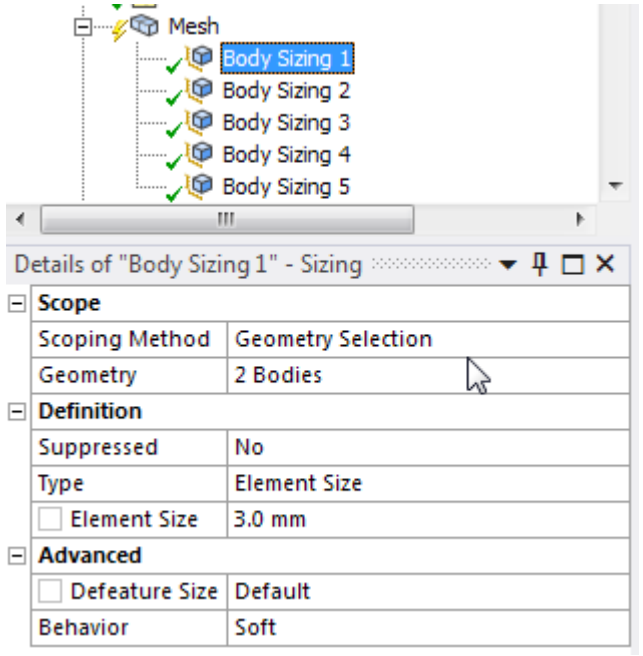
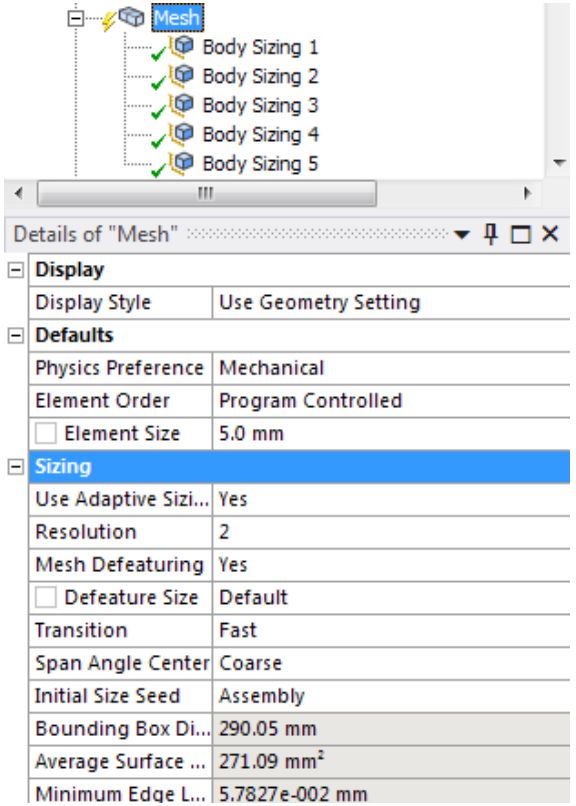
Review the existing Mesh settings:

- **Defaults**
  - **Physics Preference = Mechanical**
  - **Element Size = 5.0 mm**
- **Sizing Objects**
  - **Body Sizing 1 (Housings): Element Size = 3 mm**
  - **Body Sizing 2 Bearings: Element Size = 1.5 mm**
  - **Body Sizing 3 Grounds: Element Size = 6 mm**
  - **Body Sizing 4 Rings: Element Size = 1 mm**
  - **Body Sizing 5 Pulley: Element Size = 2 mm**





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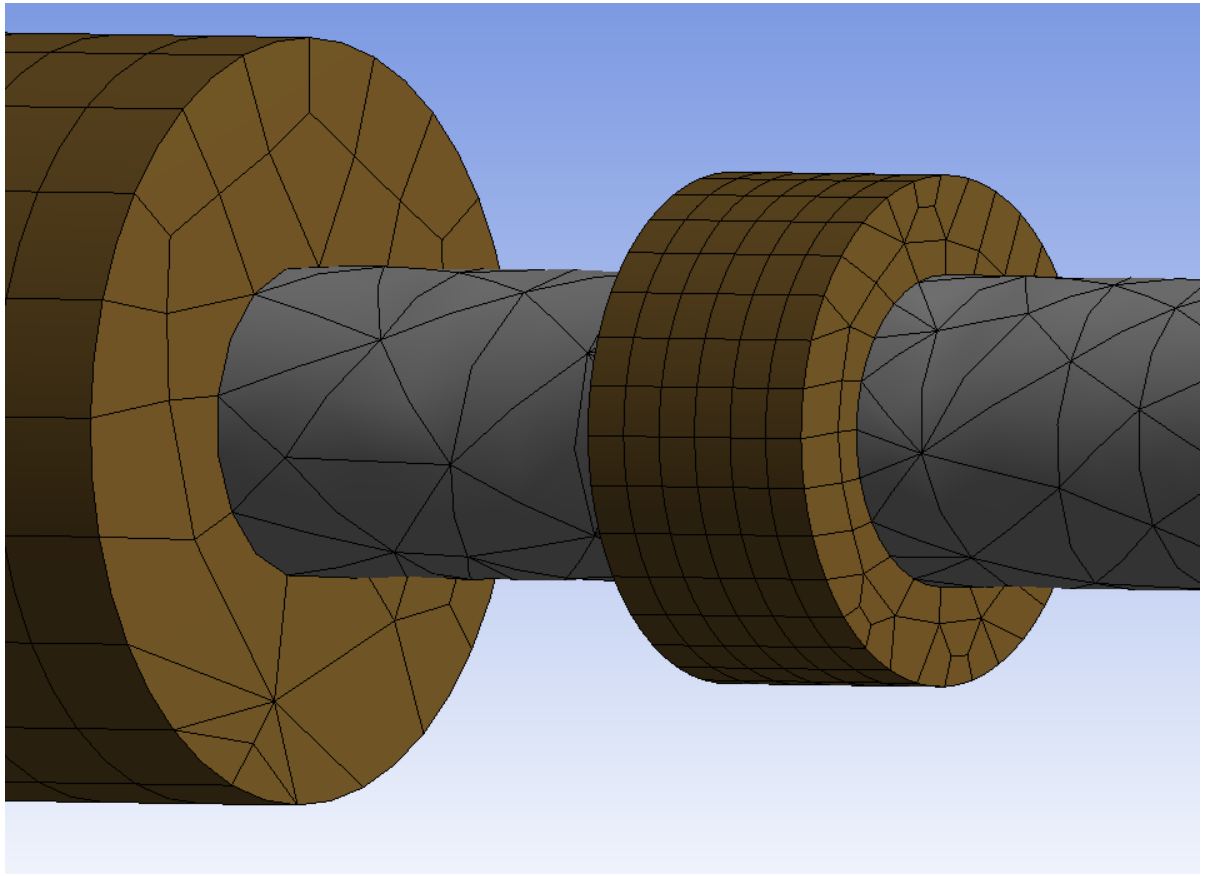
Generate the mesh on the model using the existing mesh settings, and note the mesh connectivity between the Pulleys and the Shaft resulting from the Shared Topology Shaft part:



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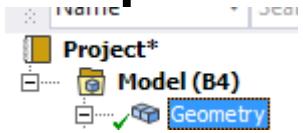
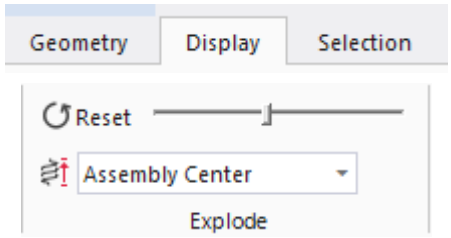
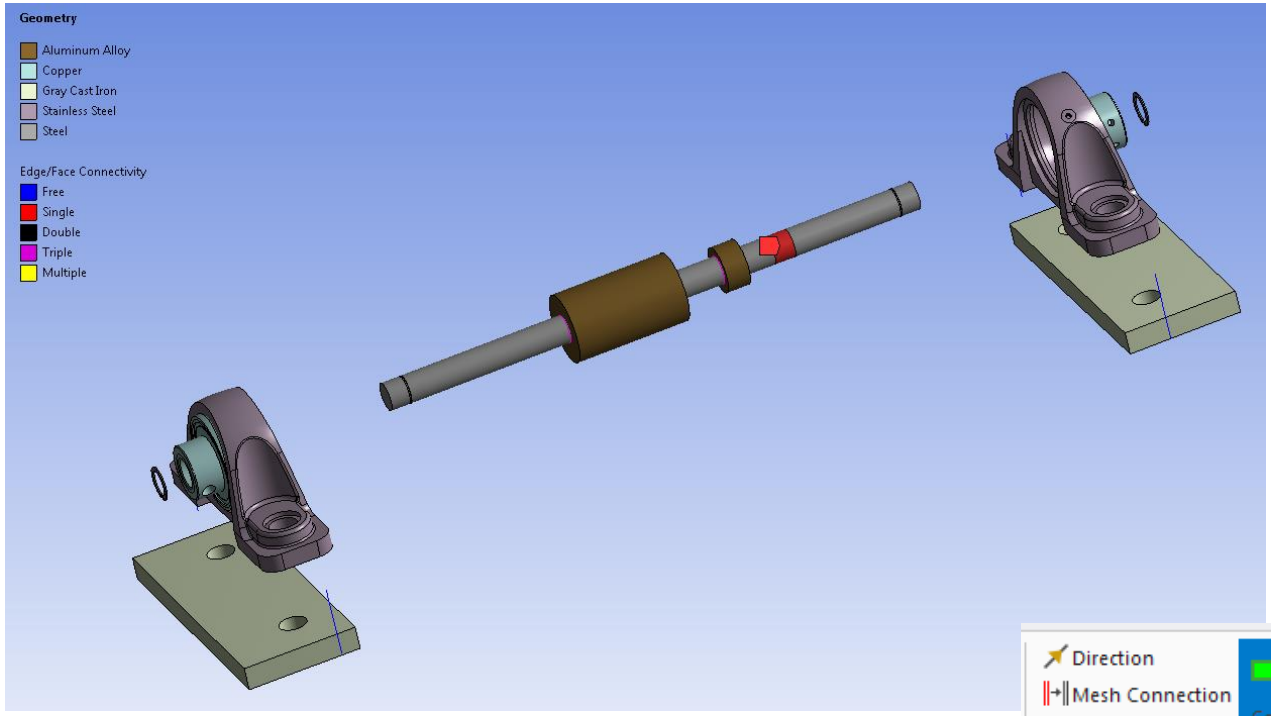
Confirm sharing of topology on the Shaft part by using the Explode tool; note the Shaft body and Pulley bodies explode as 1 connected part:

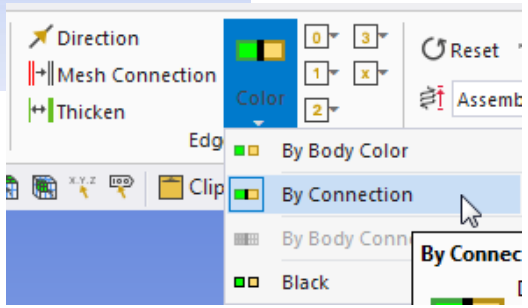
- Select the **Geometry** Branch
- Explode the assembly using the **Explode** slider in the Display tab







- You can also use the **Edge Coloring** tool to review geometry connections



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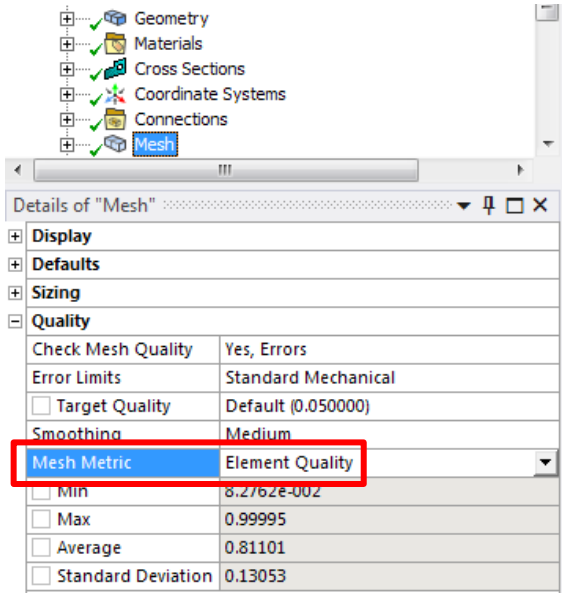
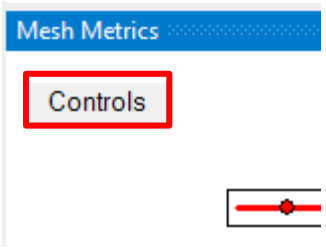
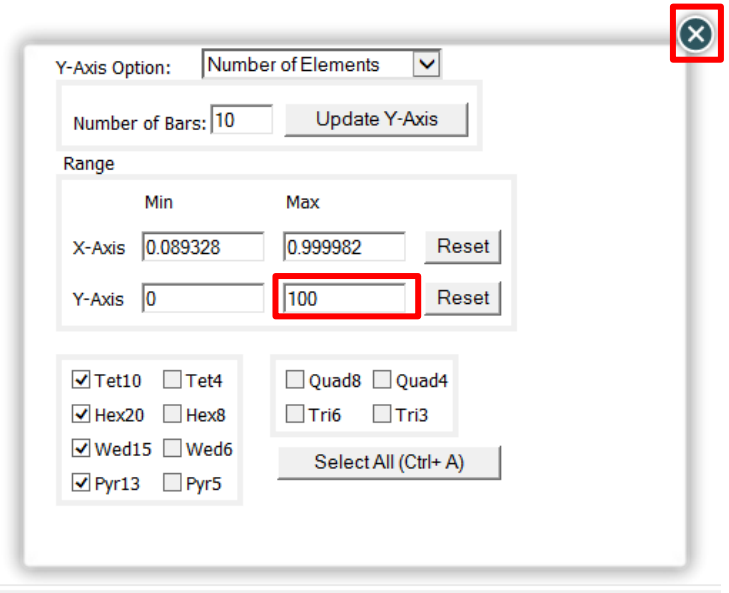
View bad quality elements:

- In details of Mesh: **Quality—Mesh Metric** = **Element Quality**
- Click **Controls** in Mesh Metrics window
- Set **Y-Axis Max** to **100**
- Close the **Y-Axis Option** dialog to display the Mesh Quality histogram







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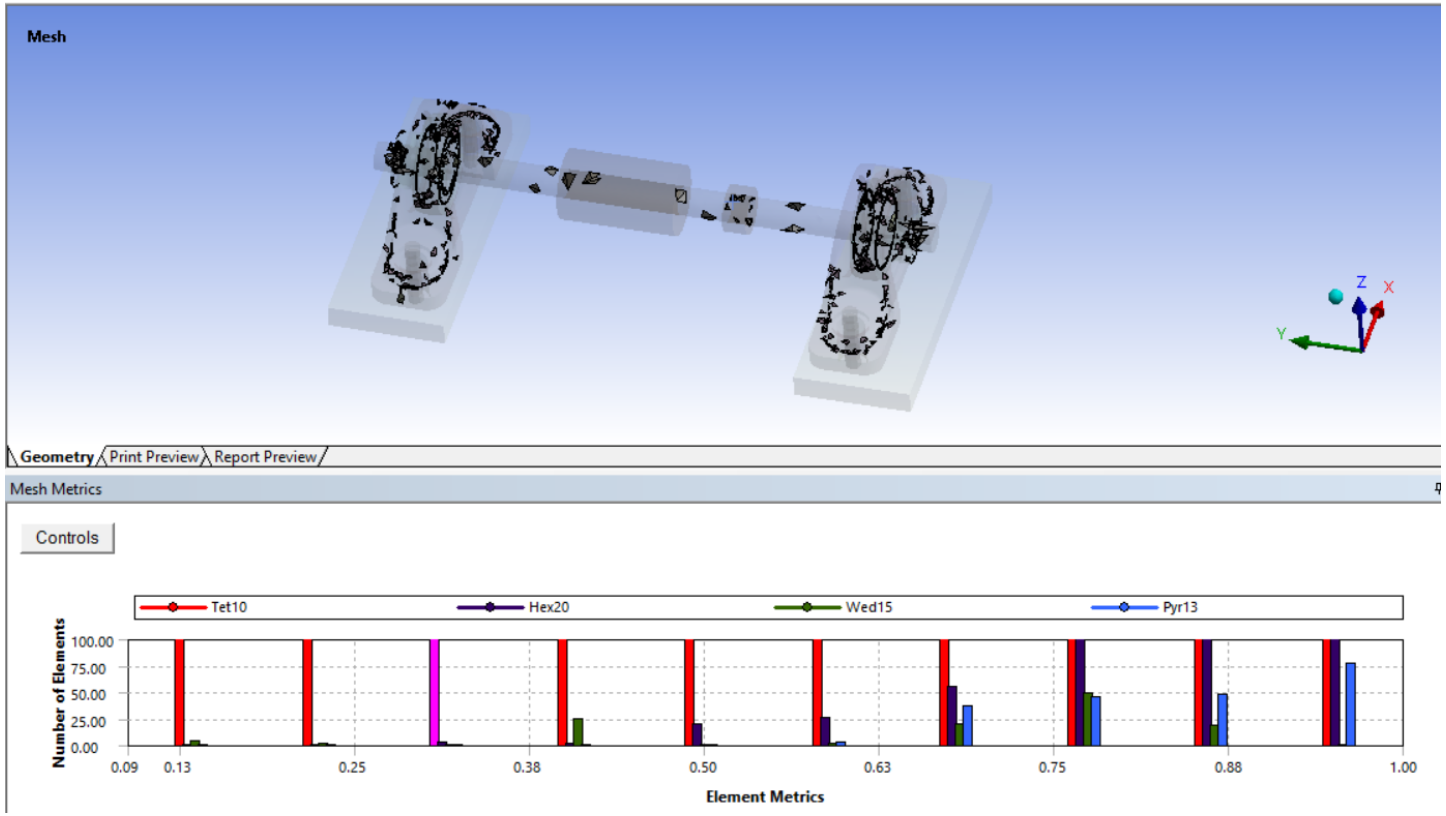
View the locations of the bad quality elements:

- Select individual bars on the graph to display only elements of that Element Quality
- Set **Mesh Metric** = **None** when finished



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We will refine or modify the mesh on the following bodies:

- Bearings
- Housings

} Based on the review of bad quality elements

- Pulley → Based on the presence of wedges in the body

- Shaft → This part is our primary interest, so we'll refine the mesh to produce at least a few elements along a diameter and (thus) more accurate results. This is particularly important because the shaft is subjected to bending, and we'll need several elements along a diameter to portray bending accurately and to resolve the variation of bending stress on a cross-section.

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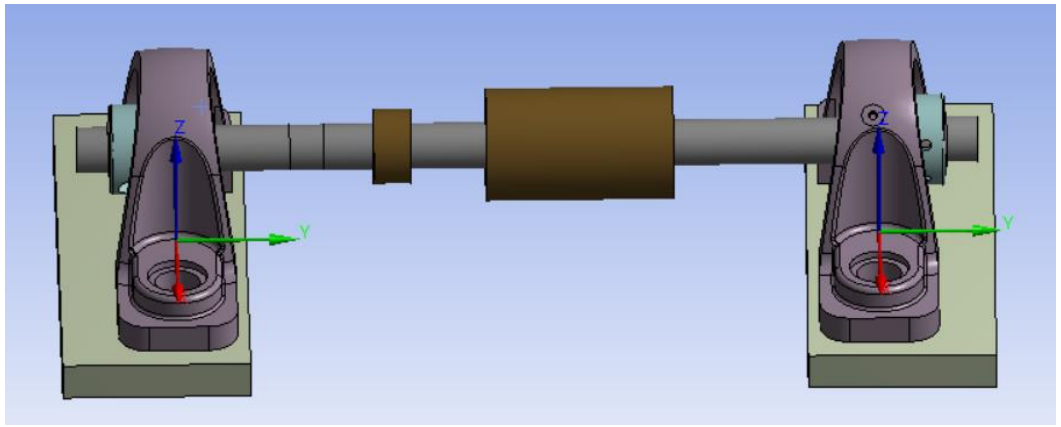
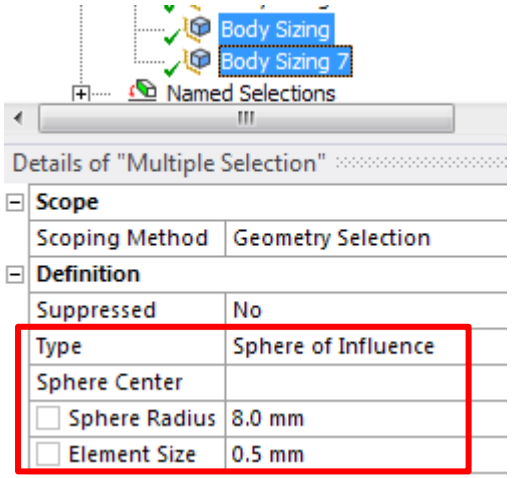
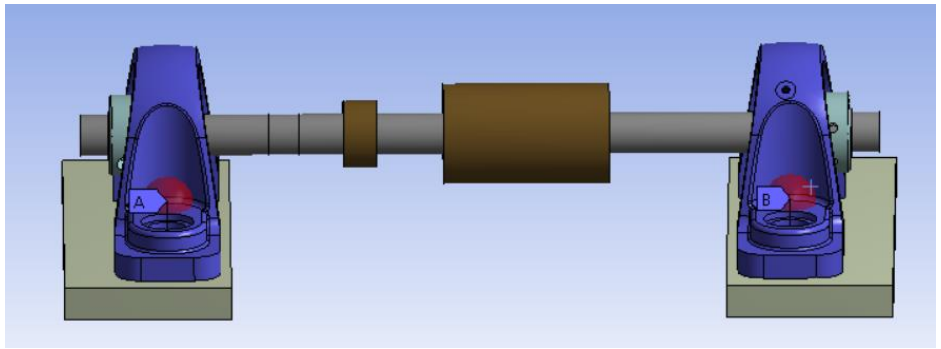
Define the following settings:

- 2 **Body Sizings** on the **Housings**. Use **Spheres of Influence**. Select each housing body shown below, right, and set **Definition Type** to **Sphere of Influence**. Use Radius and Element Size shown below.
- The definition of coordinate systems at each refinement location is required for sphere of influence controls; these are already defined as Coordinate Systems 3 and 4.







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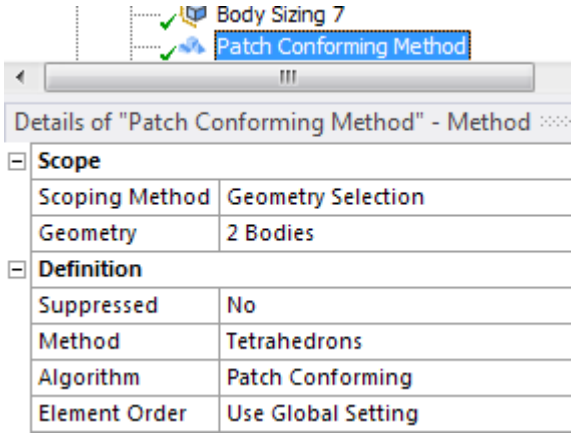
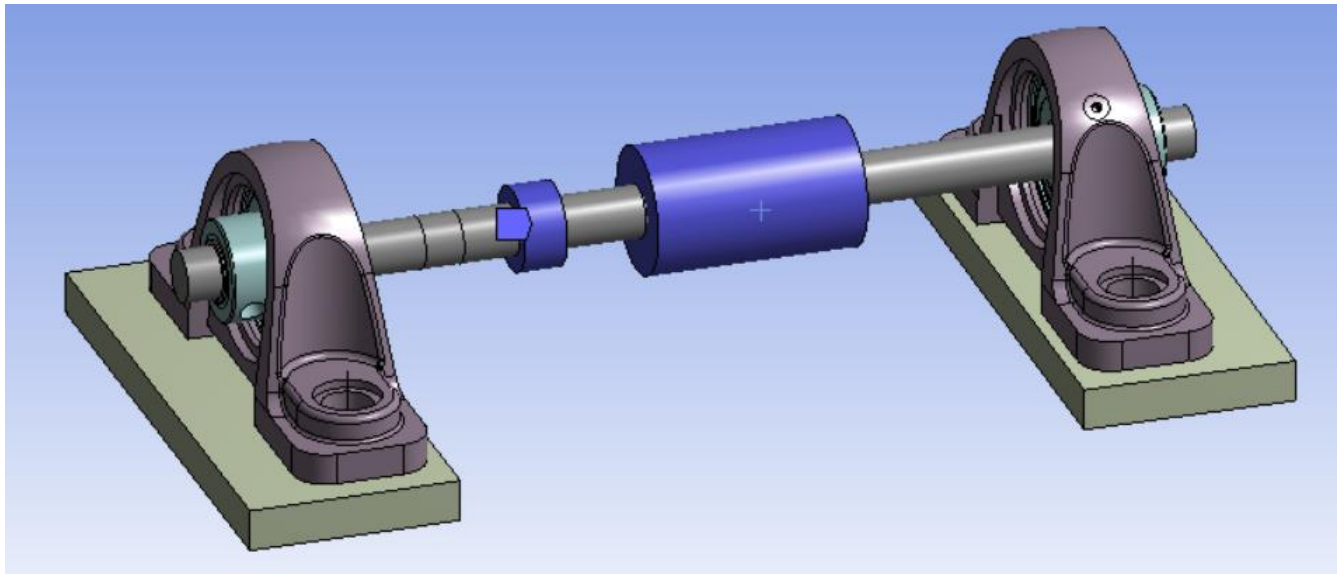
Define the following settings:

- A **Tetrahedrons, Patch Conforming** method on the Pulleys





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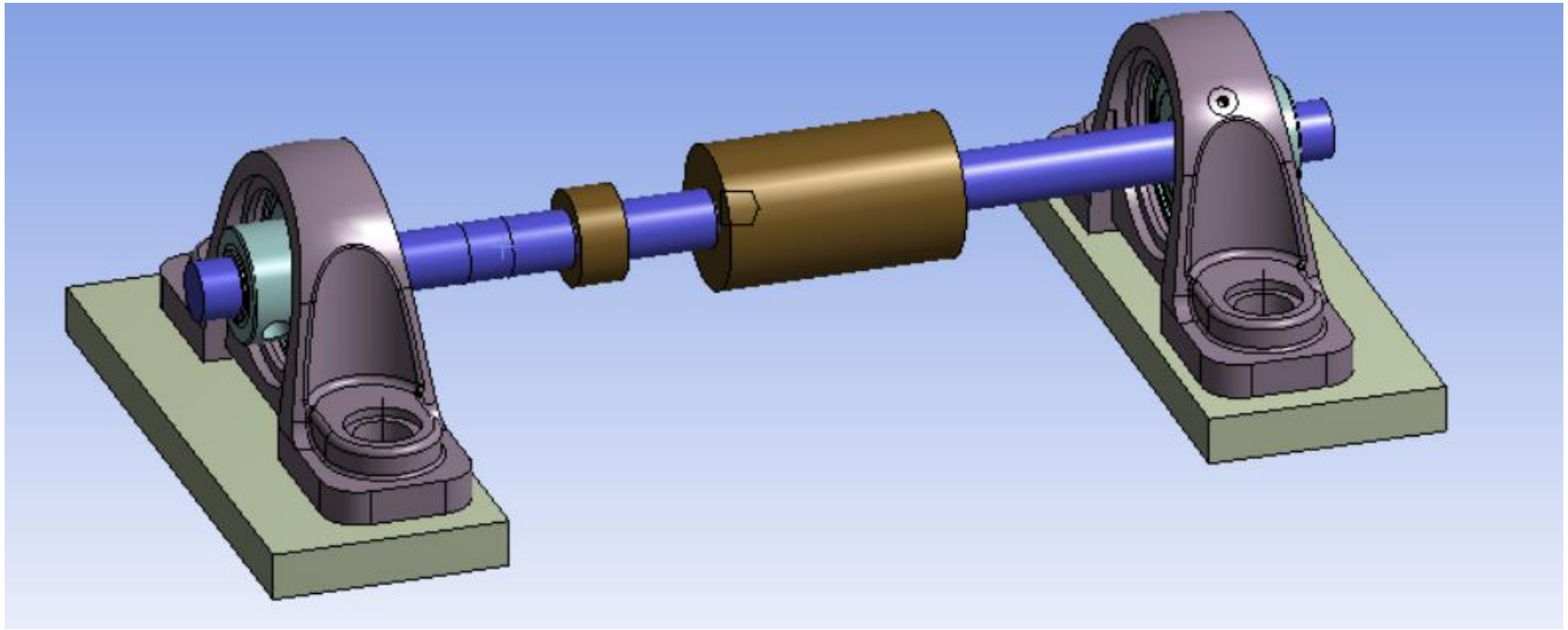
Define the following settings:

- A **Body Sizing** of 4 mm on the Shaft



- **Generate Mesh**

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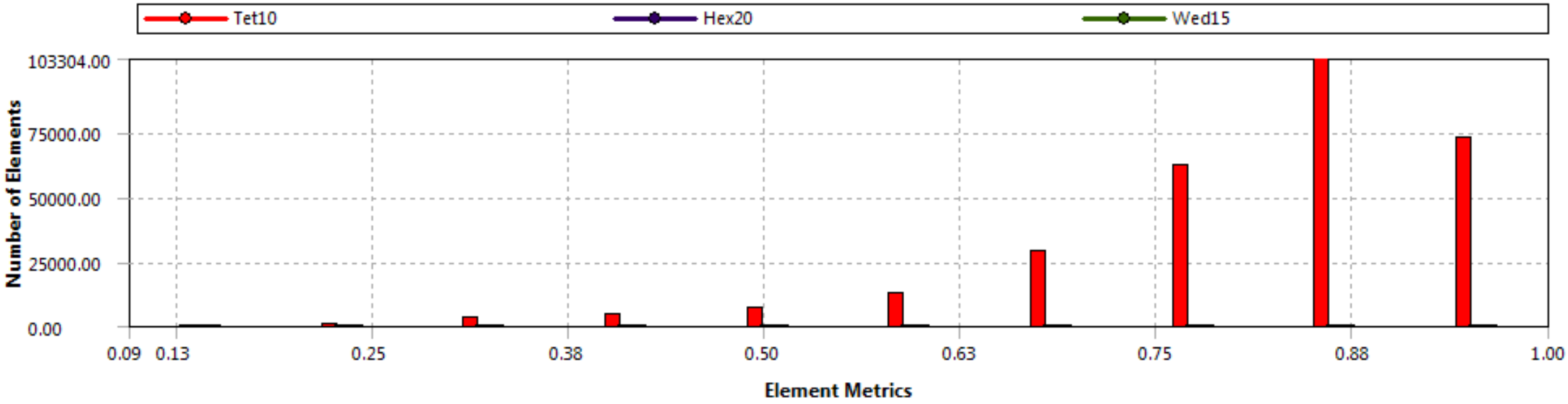
- **Review** the generated mesh
- Review the Mesh Quality Statistics and compare it to the previous generated mesh.



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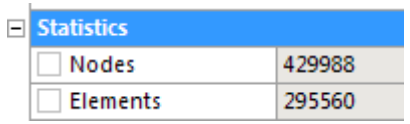
Interrogate the mesh for purposes of determining node count and approximating degrees of freedom and resulting memory requirements for the solution

- **Mesh → Statistics → Nodes**
- Node count ≅ 430,000
- 3 DOF per node ≅ 1,320,000 DOF
- 10-20 GB RAM / 1 M DOF
- This model will require a minimum of 20 GB RAM to solve in-core



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- The newly-generated mesh may alter contact detection, as contact detection is based on the mesh, not on the solid geometry
- Therefore, it is a good practice to regenerate the Initial Contact Results after mesh generation and before solution
- Are these results acceptable? Why or why not?
- The contact region highlighted in yellow is detected as open. This is not problematic for the re-solution since it is a nonlinear contact—its status can change during the re-solution.

Name	Contact Side	Type	Status	Number Contacting	Penetration (mm)	Gap (mm)	Geometric Penetration (mm)	Geometric Gap
Bonded - Bearing\Bearing To Housing\Housing	Contact	Bonded	Closed	1797.	3.7471e-014	0.	1.0872e-003	1.2832e-003
Bonded - Bearing\Bearing To Housing\Housing	Target	Bonded	Inactive	N/A	N/A	N/A	N/A	N/A
Frictional - Bearing\Bearing To Ring\Ring	Contact	Frictional	Inactive	N/A	N/A	N/A	N/A	N/A
Frictional - Bearing\Bearing To Ring\Ring	Target	Frictional	Closed	57.	3.5527e-015	0.	3.5527e-015	2.366e-030
Bonded - Bearing\Bearing To Shaft\Component4\Shaft	Contact	Bonded	Closed	795.	1.8869e-015	0.	0.	0.25883
Bonded - Bearing\Bearing To Shaft\Component4\Shaft	Target	Bonded	Inactive	N/A	N/A	N/A	N/A	N/A
Frictionless - Housing\Housing To Ground\Ground	Contact	Frictionless	Closed	448.	1.4211e-014	0.	1.4211e-014	1.0819e-029
Frictionless - Housing\Housing To Ground\Ground	Target	Frictionless	Inactive	N/A	N/A	N/A	N/A	N/A
Bonded - Housing\Housing To Bearing\Bearing	Contact	Bonded	Inactive	N/A	N/A	N/A	N/A	N/A
Bonded - Housing\Housing To Bearing\Bearing	Target	Bonded	Closed	1437.	7.5676e-014	0.	0.27126	0.13543
Frictionless - Housing\Housing To Ground\Ground	Contact	Frictionless	Closed	448.	1.4211e-014	0.	1.4211e-014	1.6394e-029
Frictionless - Housing\Housing To Ground\Ground	Target	Frictionless	Inactive	N/A	N/A	N/A	N/A	N/A
Bonded - Ring\Ring To Shaft\Component4\Shaft	Contact	Bonded	Closed	73.	3.5527e-015	0.	9.0441e-006	0.14
Bonded - Ring\Ring To Shaft\Component4\Shaft	Target	Bonded	Inactive	N/A	N/A	N/A	N/A	N/A
Frictional - Ring\Ring To Bearing\Bearing	Contact	Frictional	Closed	55.	5.6843e-014	0.	5.6843e-014	1.5558e-028
Frictional - Ring\Ring To Bearing\Bearing	Target	Frictional	Inactive	N/A	N/A	N/A	N/A	N/A
Bonded - Ring\Ring To Shaft\Component4\Shaft	Contact	Bonded	Closed	75.	2.8422e-014	0.	9.6032e-006	0.14

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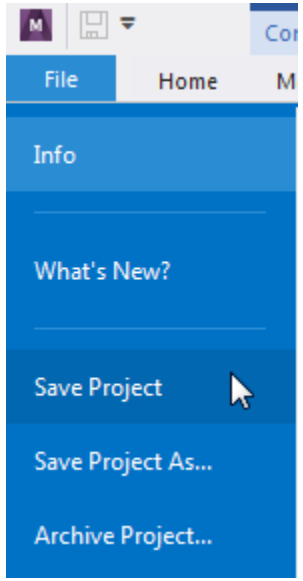
Save Project for use later if desired.

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