SESAM TUTORIAL

GeniE

Conditional Regenerate Mesh

Valid from program version 8.2

Sesam Tutorial

GeniE – Conditional Regenerate Mesh

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Valid from GeniE version 8.2

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TABLE OF CONTENTS

1 INTRODUCTION

- In a model with two or more connected surfaces, and for which a FE mesh has already been created, one (or a subset) of the surfaces may need remeshing. This may be caused by:
  - Change in geometry
  - Dividing surface(s)
  - Insertion of feature edge(s)
  - Change of mesh property

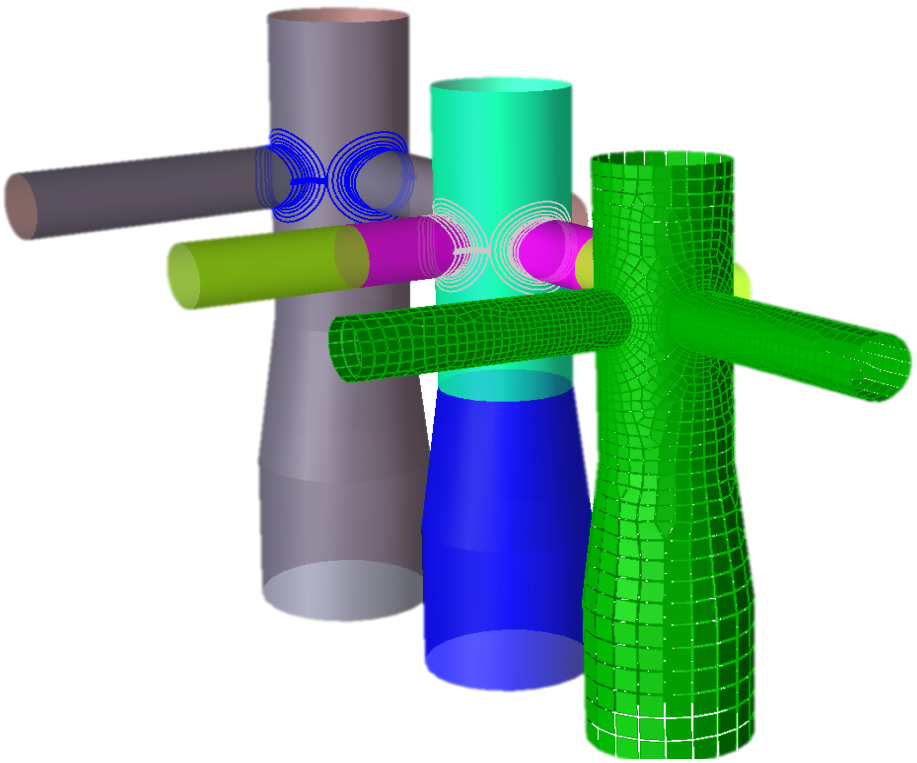
- By default, remeshing of one (or a subset) of the surfaces will not affect the other surface(s). This means that the mesh transitions required for the surface meshes to fit will be confined to the remeshed surface(s).

- The advantages of this are:
  - Speed-up of the mesh adjustment process by keeping existing mesh
  - Preserve node and element numbering for unchanged surfaces

- Note that modifying properties like material, thickness and boundary conditions will update the finite element model but not entail a remeshing.

- However, remeshing of surfaces may be enforced, optionally including adjacent surfaces.

- This tutorial is an exercise in using the abovementioned features by importing a tubular joint model.

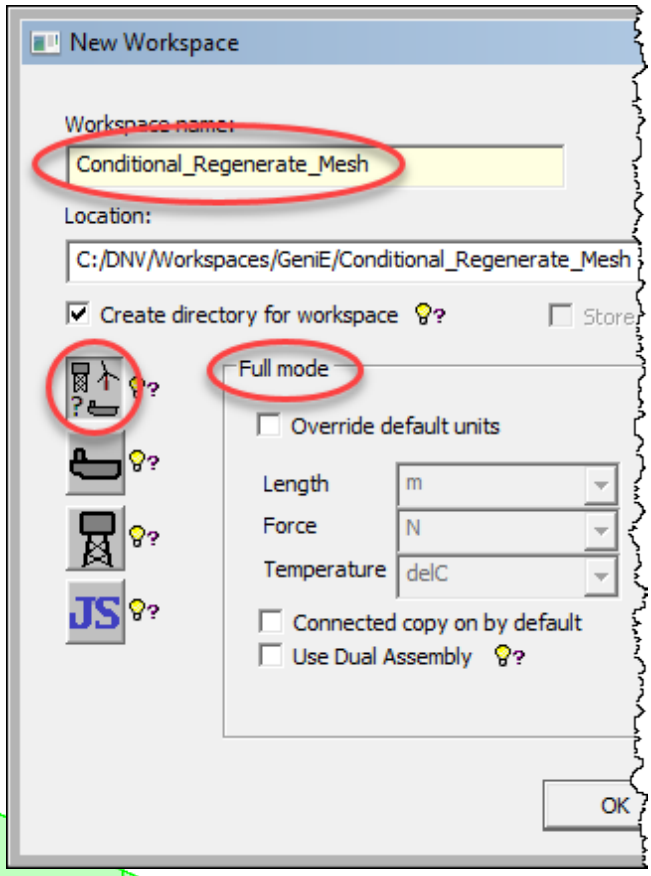


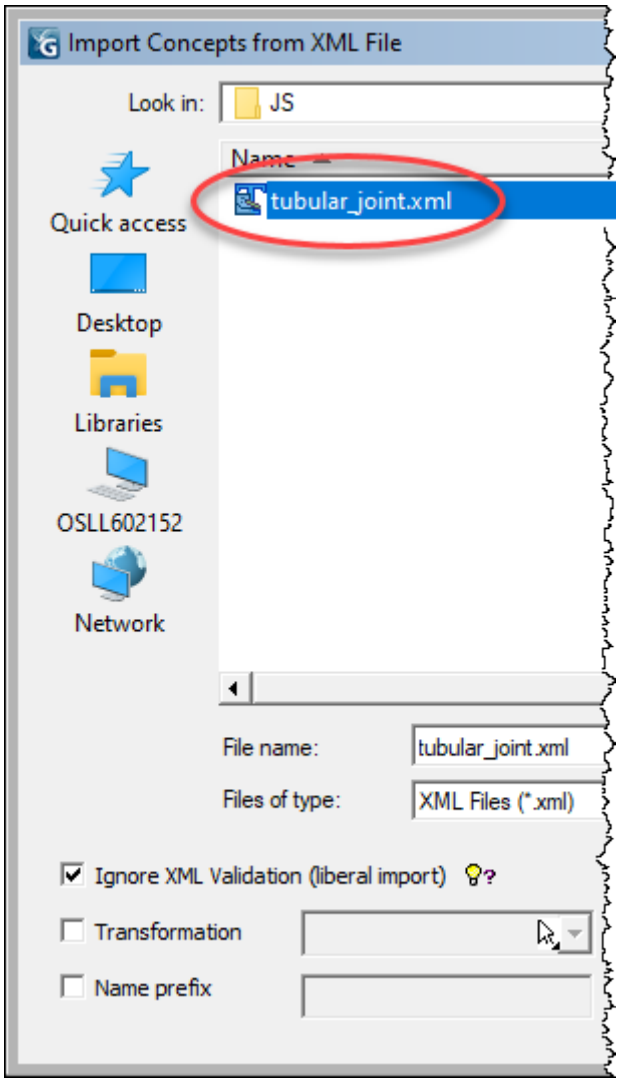
2 CREATE A NEW WORKSPACE AND IMPORT A MODEL

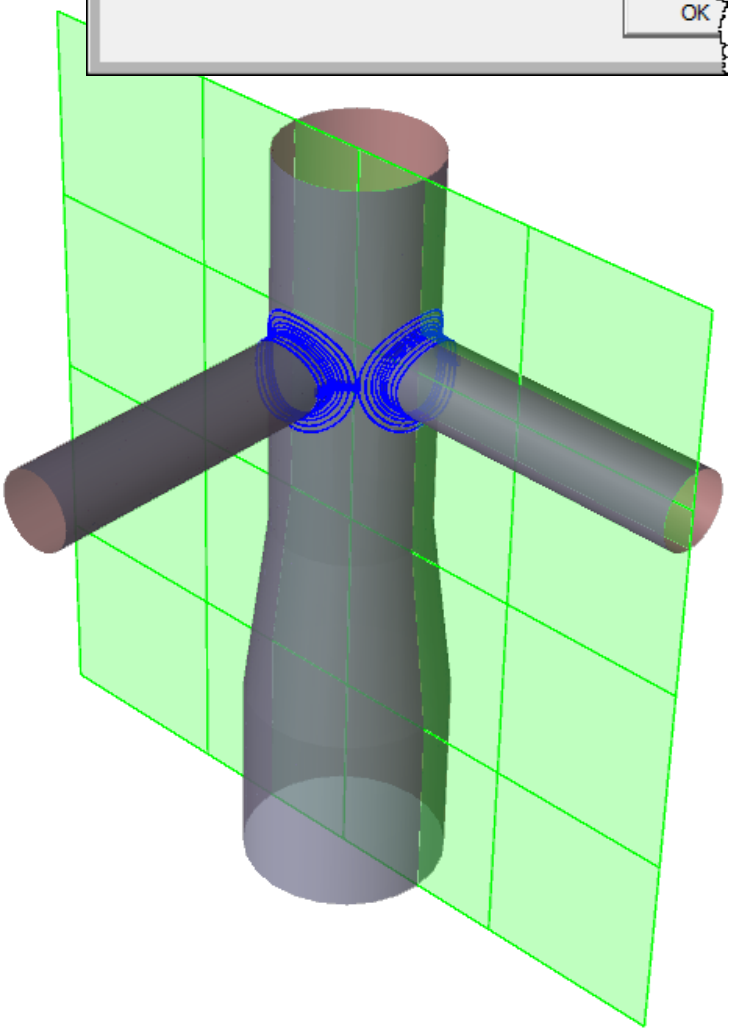
- Start GeniE and open a new workspace.
  - Give a workspace name, for example Conditional_Regenerate_Mesh.
  - Press the *Full mode* button to open for curved geometry modelling.
  - Accept default units m and N and click OK.

- Use *File* | *Import* | *XML Concept Model* to import the file tubular_joint.xml. The file is found as part of the installation, typically at: C:\Program Files\DNV\GeniE VX.Y-ZZ\Help\Tutorials\TutorialsAdvancedModelling\A11_GeniE_Conditional_Regenerate_Mesh\JS

- The model shown to the lower right appears.

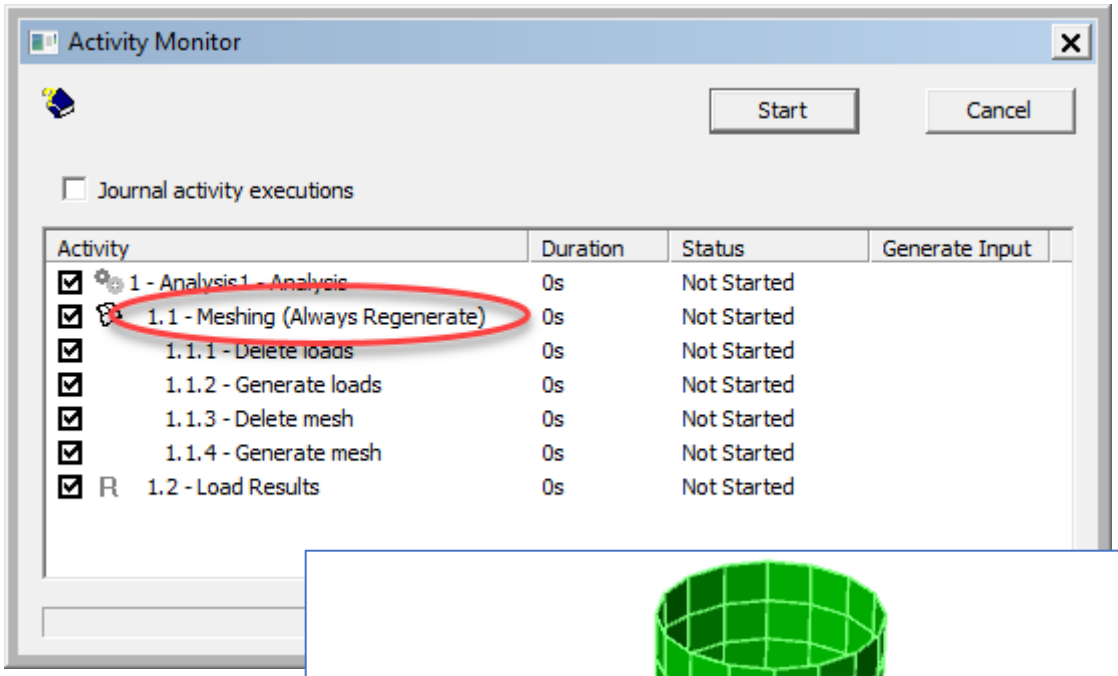


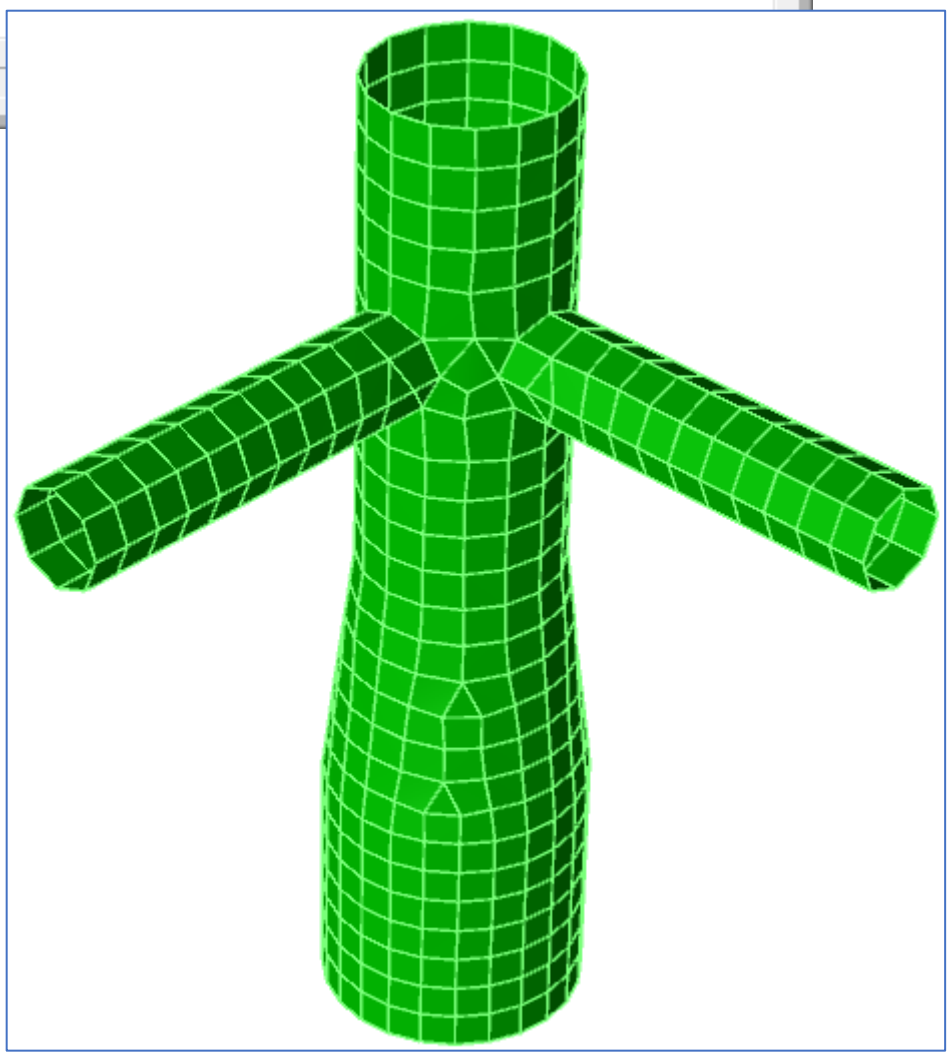




3 CREATE AN INITIAL FE MESH

- Use Alt+D to open the *Activity Monitor* shown below.
  - Notice that the activity only includes meshing and no analysis.
  - Also notice that meshing is set to *Always Regenerate*. This is because this setting is embedded in the imported model file.



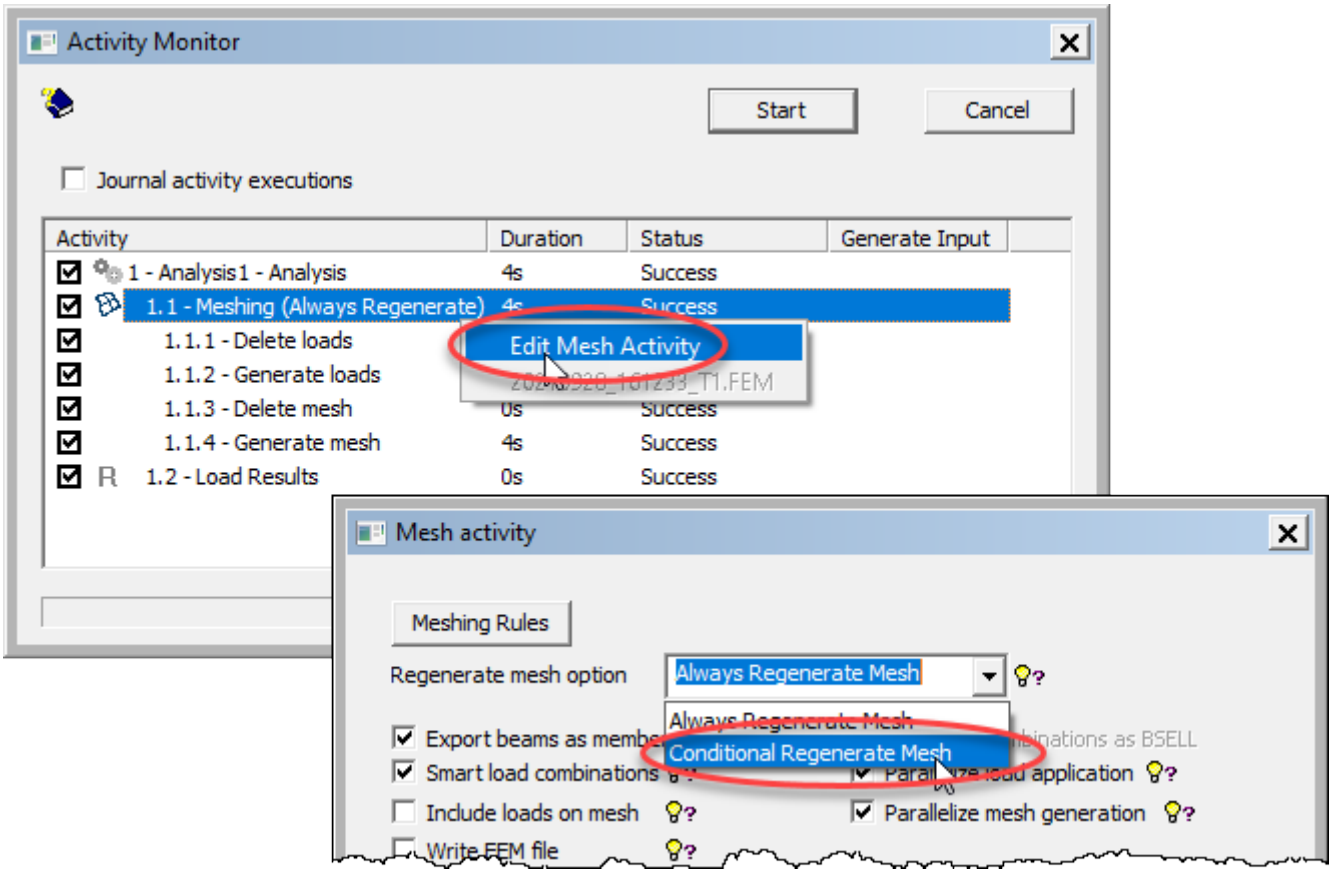


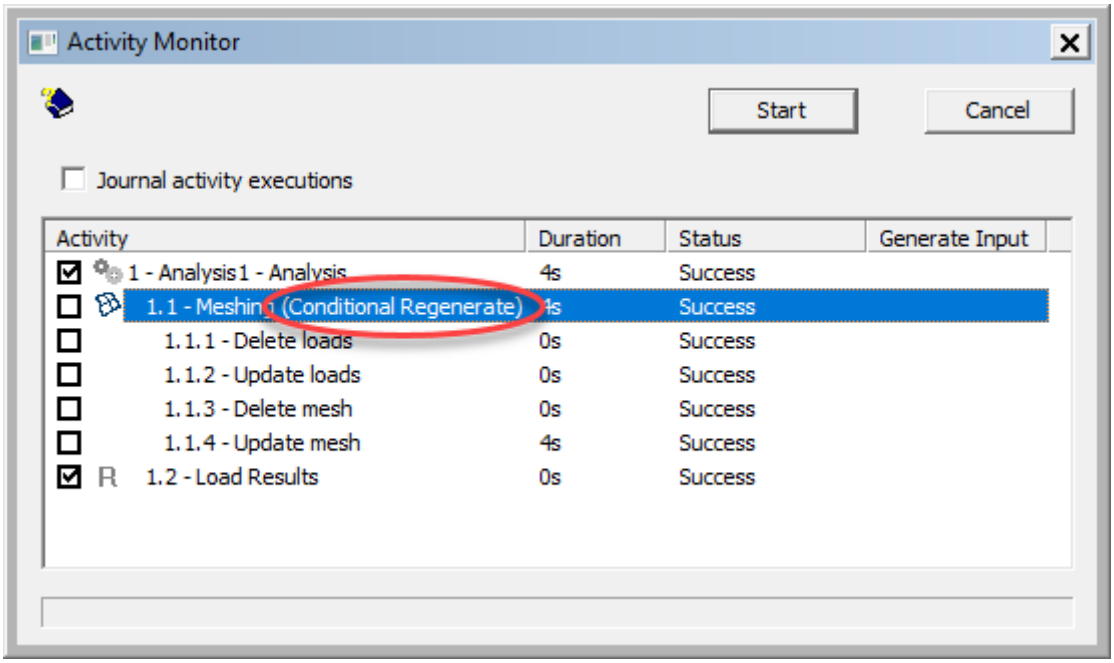
- Notice that the FE mesh is far too coarse in the intersection area between the tubes.
- The task is to refine the mesh in the intersection area while keeping (and not regenerating) the mesh towards the ends of the tubes.
- Note that the *Advancing Front Quad Mesher* has been selected for this model (embedded in the imported model).
  - Use *Edit* | *Rules* | *Meshing Rules* to verify this.

4 SWITCH TO CONDITIONAL REGENERATE MESH AND REFINE THE MESH

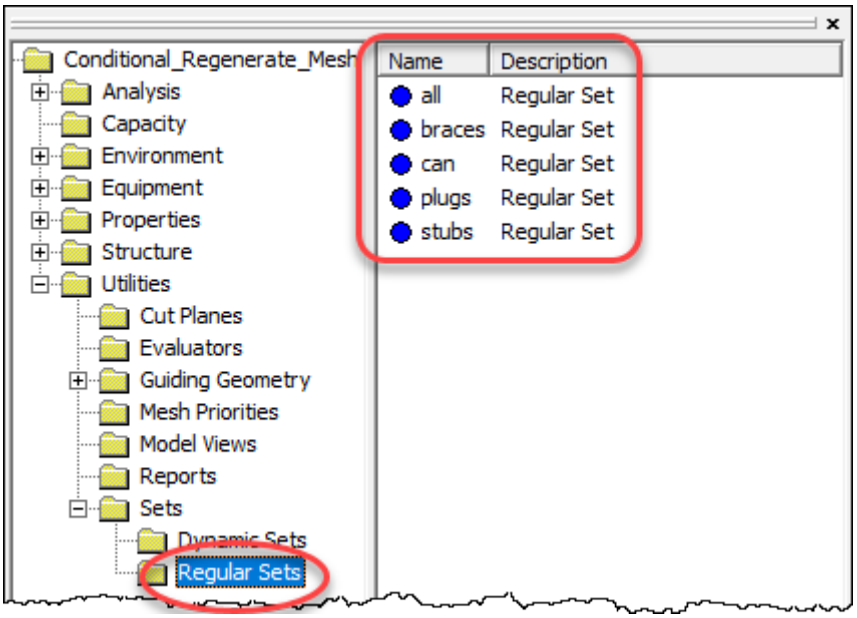
- Note that ‘conditional regenerate mesh’ is also referred to as ‘partial meshing’.

- In the *Activity Monitor* right-click the meshing activity to switch to *Conditional Regenerate Mesh*.

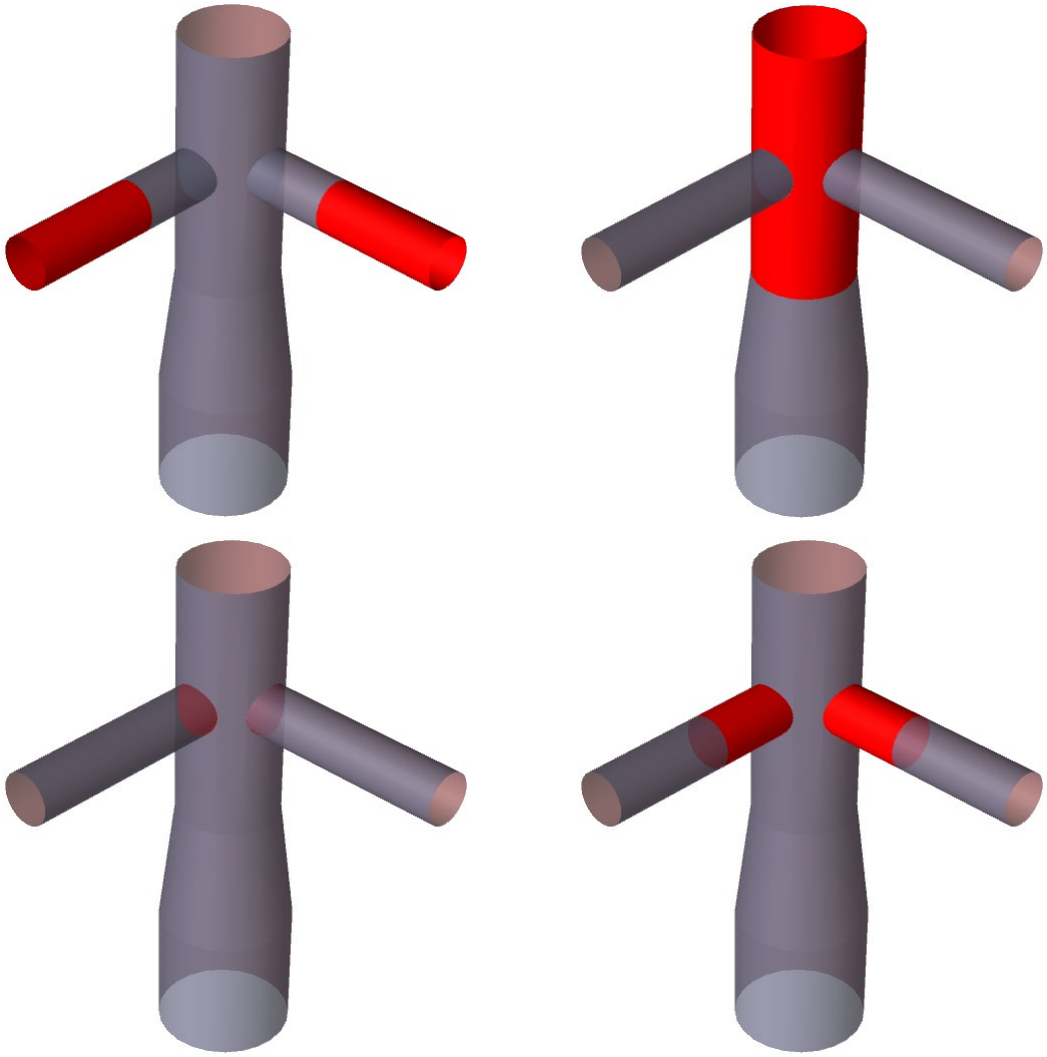




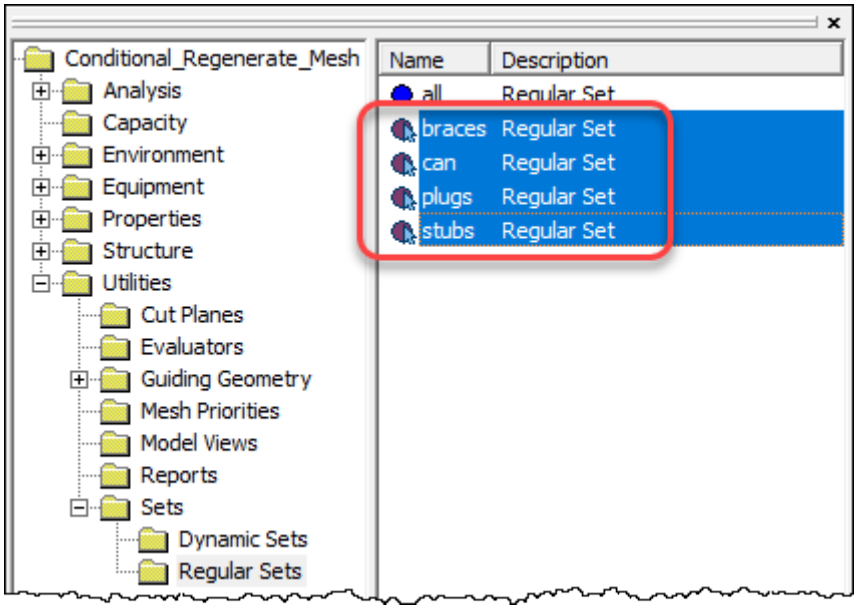
➢ There are five sets in this model. Find these in the *Utilities* | *Sets* | *Regular Sets* folder:



➢ The sets named braces, can, plugs and stubs are shown below from left to right and down.

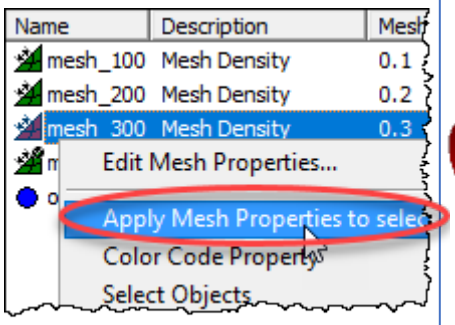


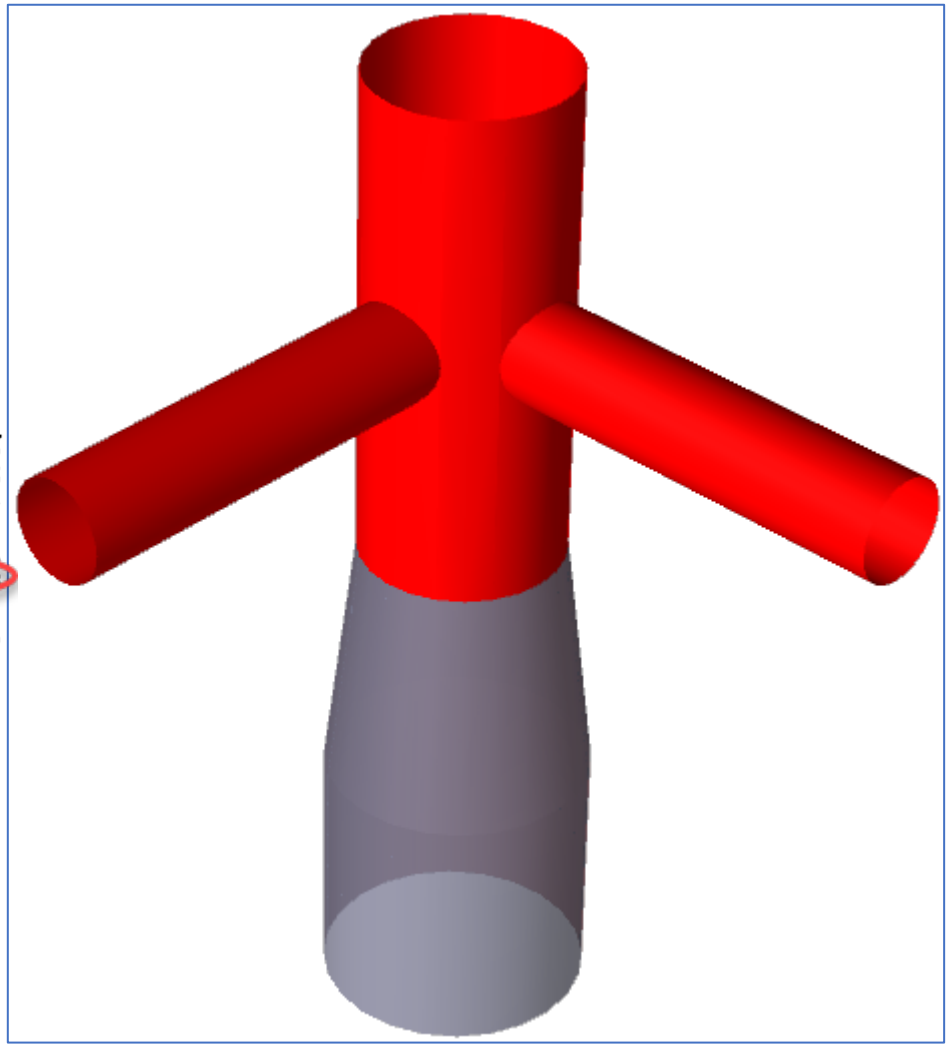
- Select the four sets shown below.



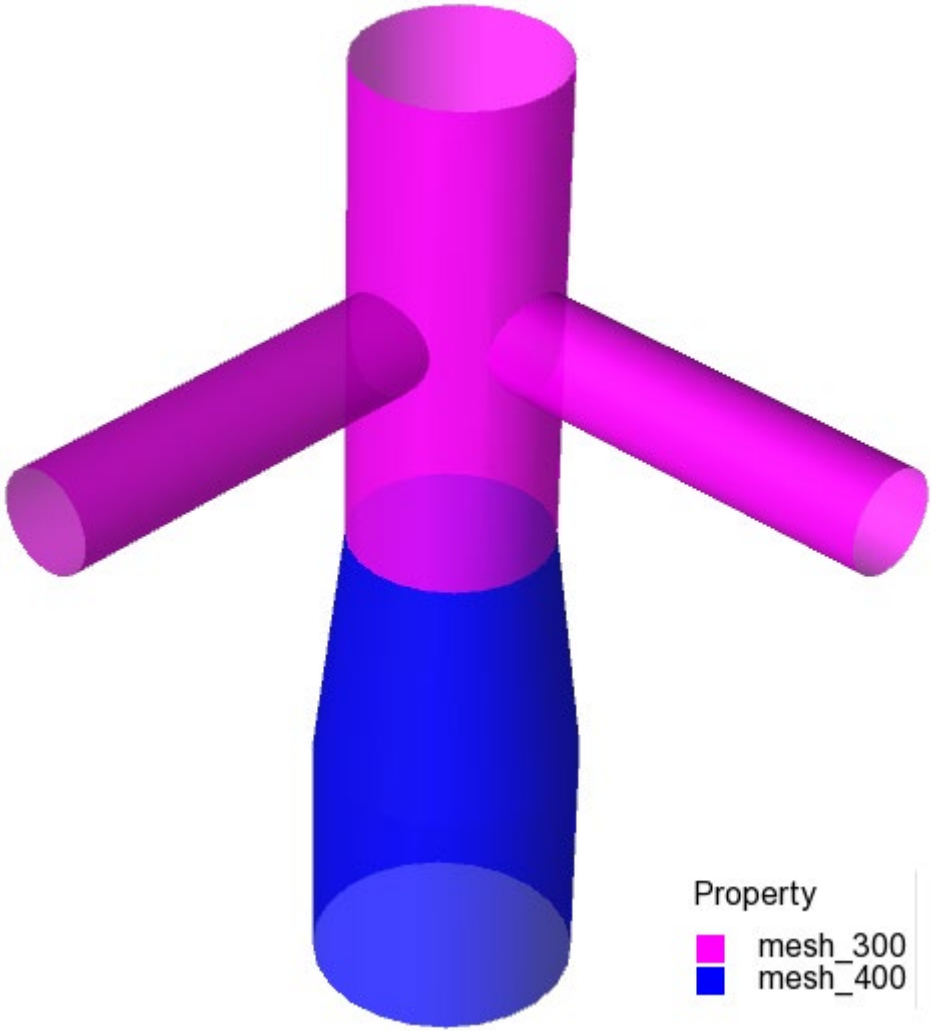
- The upper part of the model is selected as shown to the right.

- Go to the *Properties* | *Mesh* folder, select the property mesh_300 and assign this to the selected part.

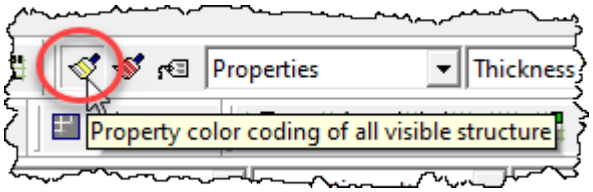




- Right-click the *Properties* | *Mesh* folder to select *Color code all visible properties*. This shows that the mesh properties mesh_300 and mesh_400 have been assigned to the model (assignment of mesh_400 was embedded in the imported model).

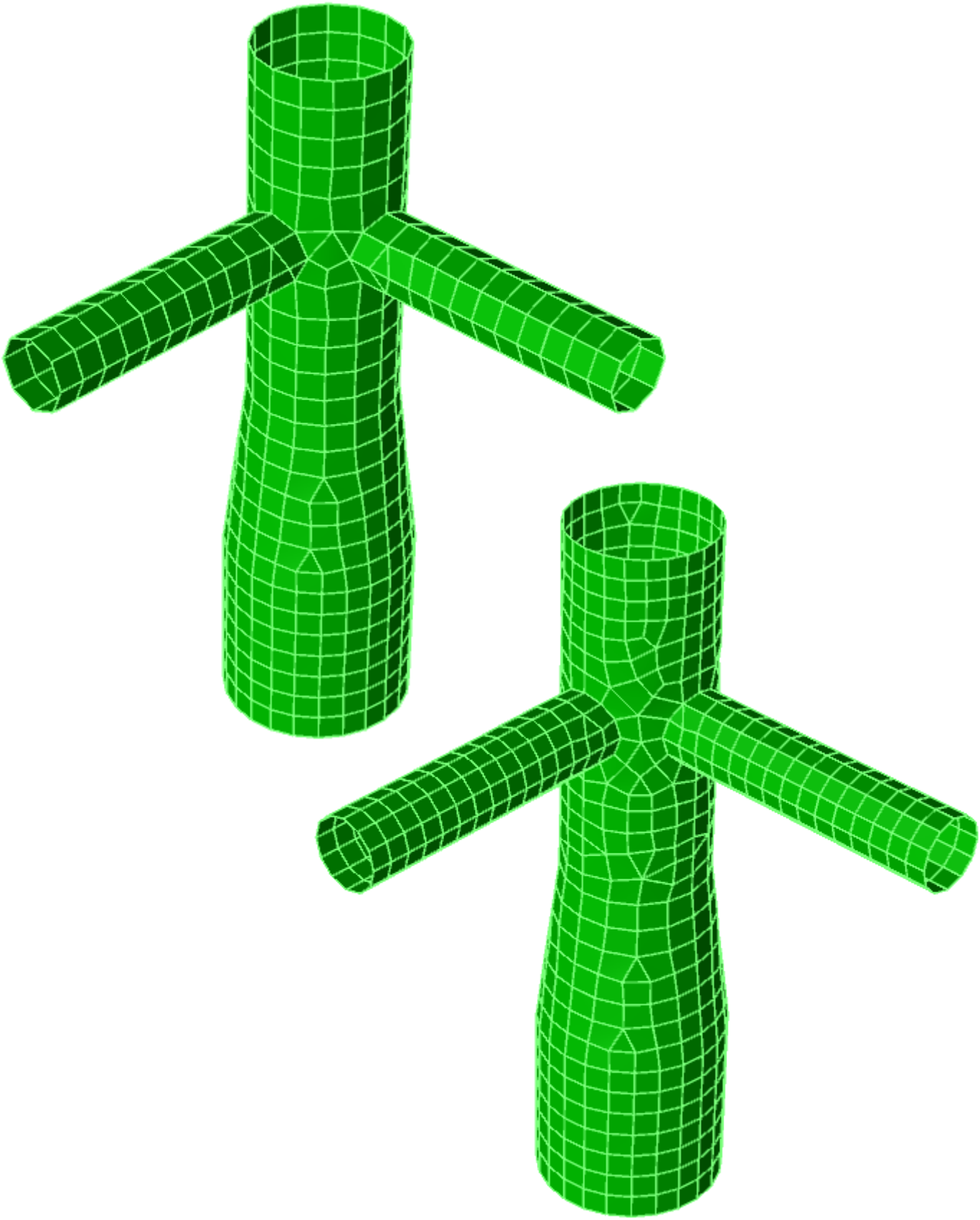


  - Click the *Property color coding of all visible structure* to lift the button thereby removing colour coding.



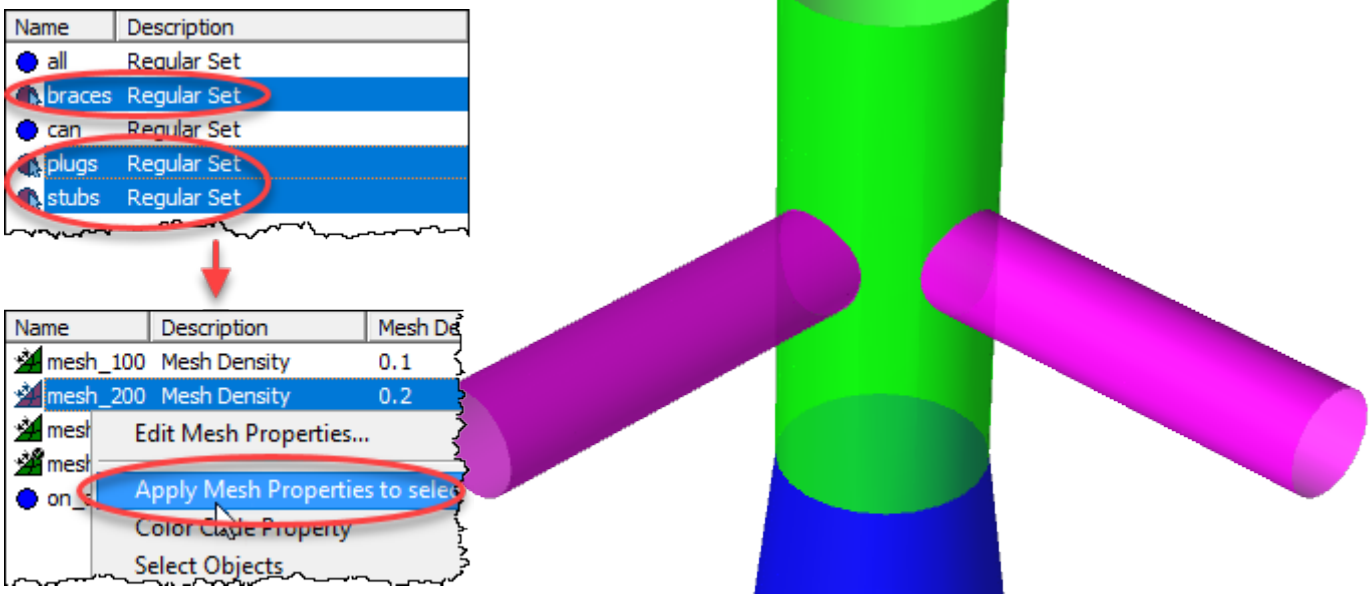
- Prior to remeshing the model, switch to *Mesh - All* display configuration so that the effect of the assignment of the mesh_300 property is immediately seen when clicking *Start* in the *Activity Monitor*.

- The meshes before (upper left) and after (lower right) are shown below. The mesh for lower part of the model is unchanged. The mesh in the tube intersection area is somewhat improved.

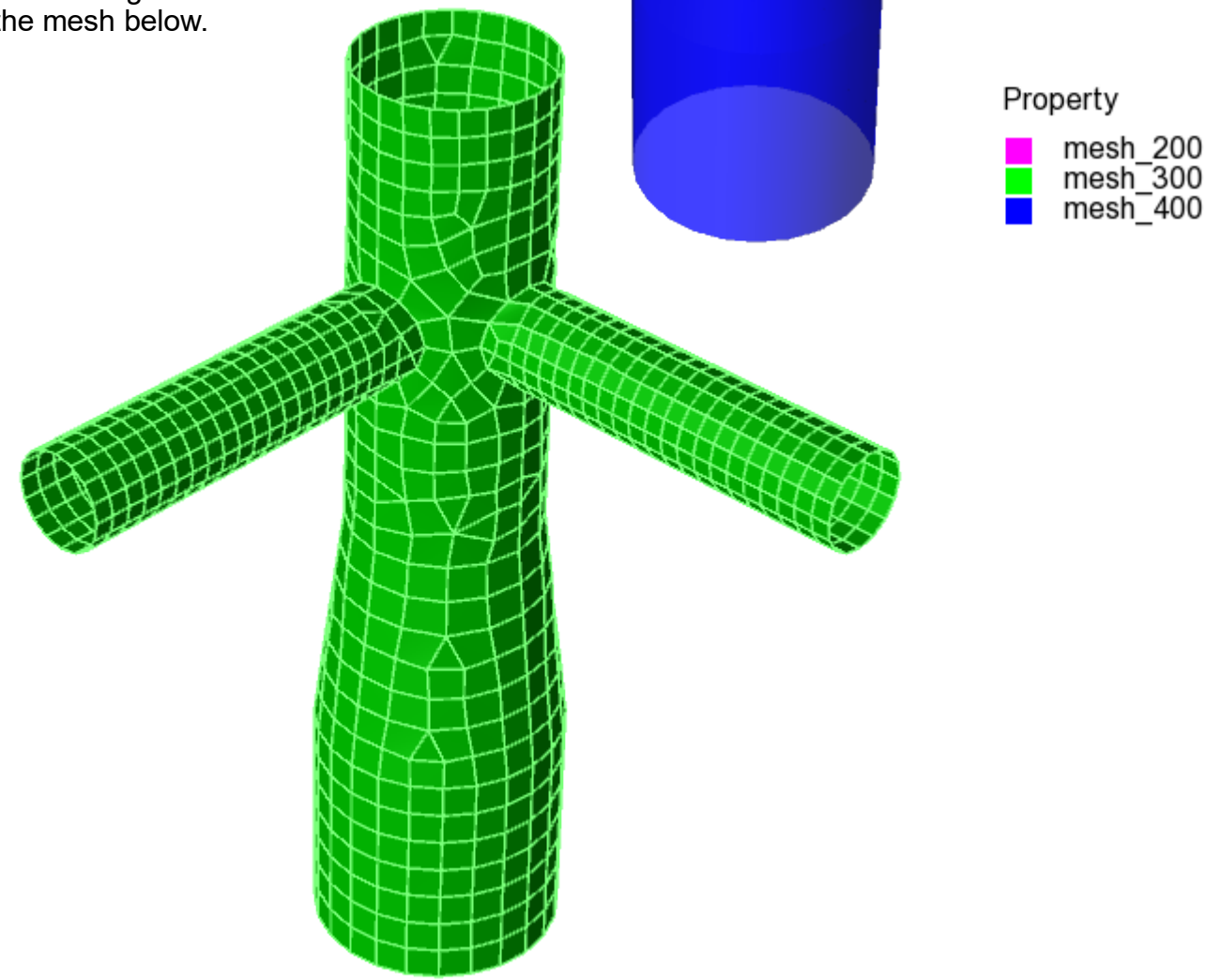


5 REFINE THE MESH FURTHER

- Assign the mesh property named mesh_200 to the three sets shown below.

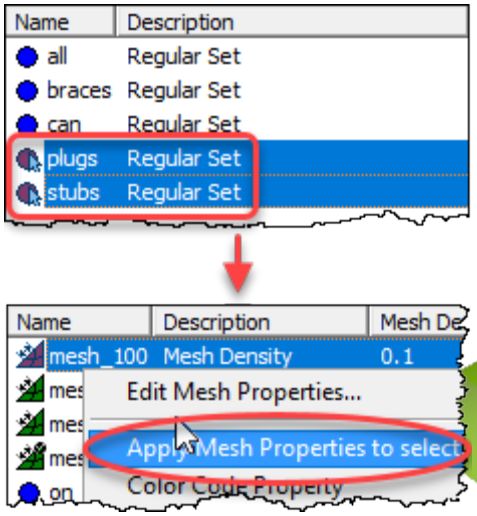


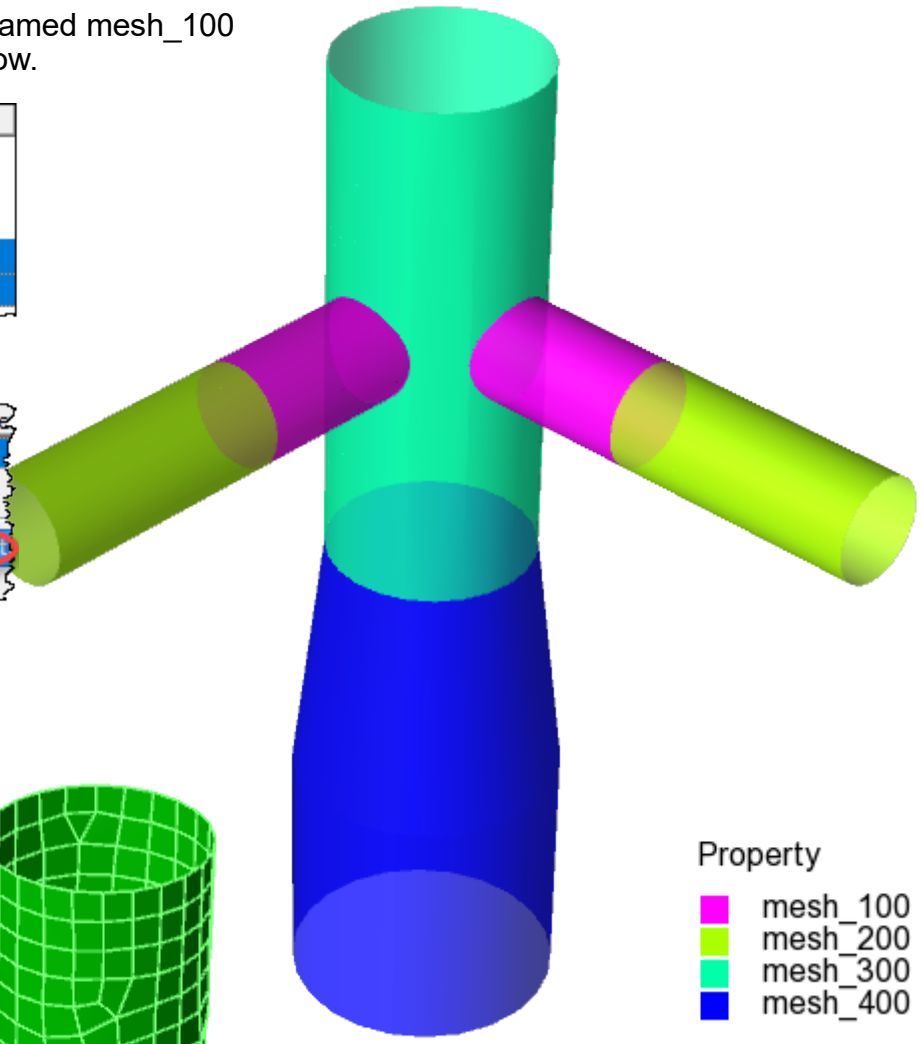
- Remeshing now creates the mesh below.



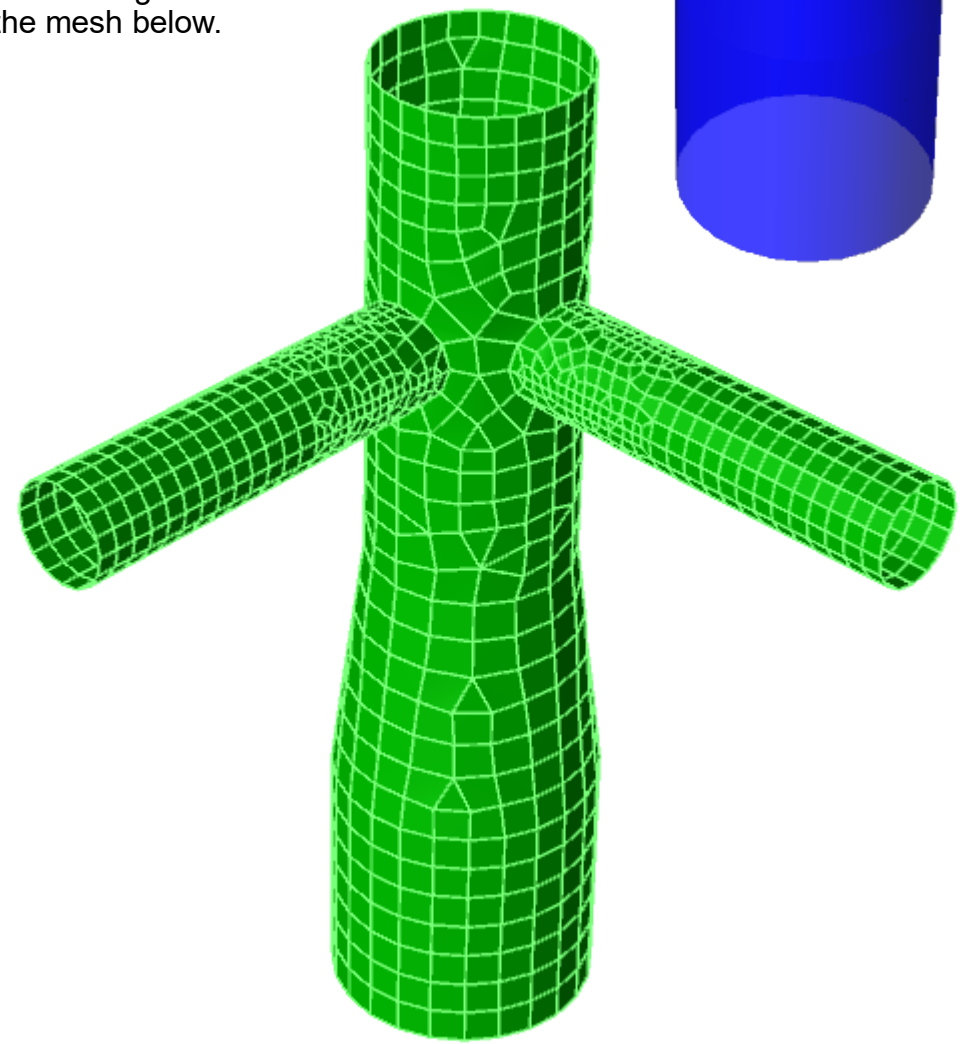
6 REFINE THE MESH EVEN FURTHER

- Assign the mesh property named mesh_100 to the three sets shown below.



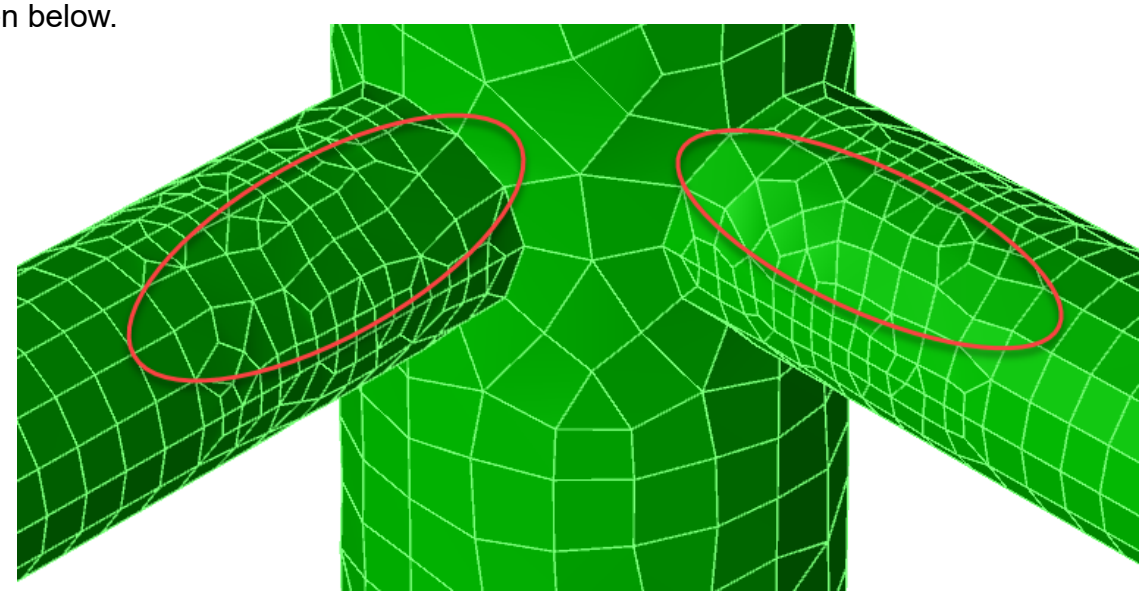


- Remeshing now creates the mesh below.



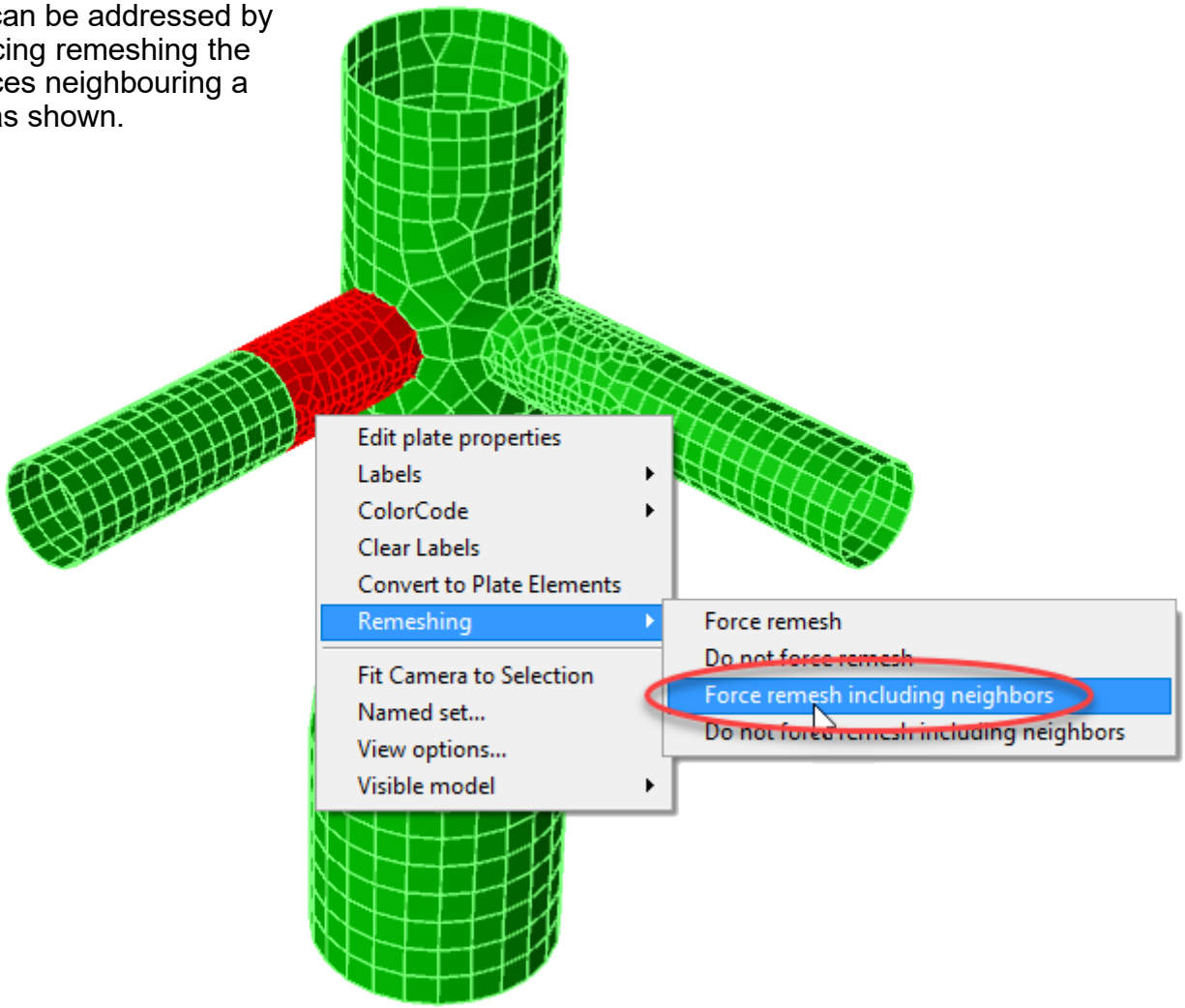
7 ENFORCE REMESHING

- The refinement of the stubs on the previous page reveals rather poor element quality as seen below.

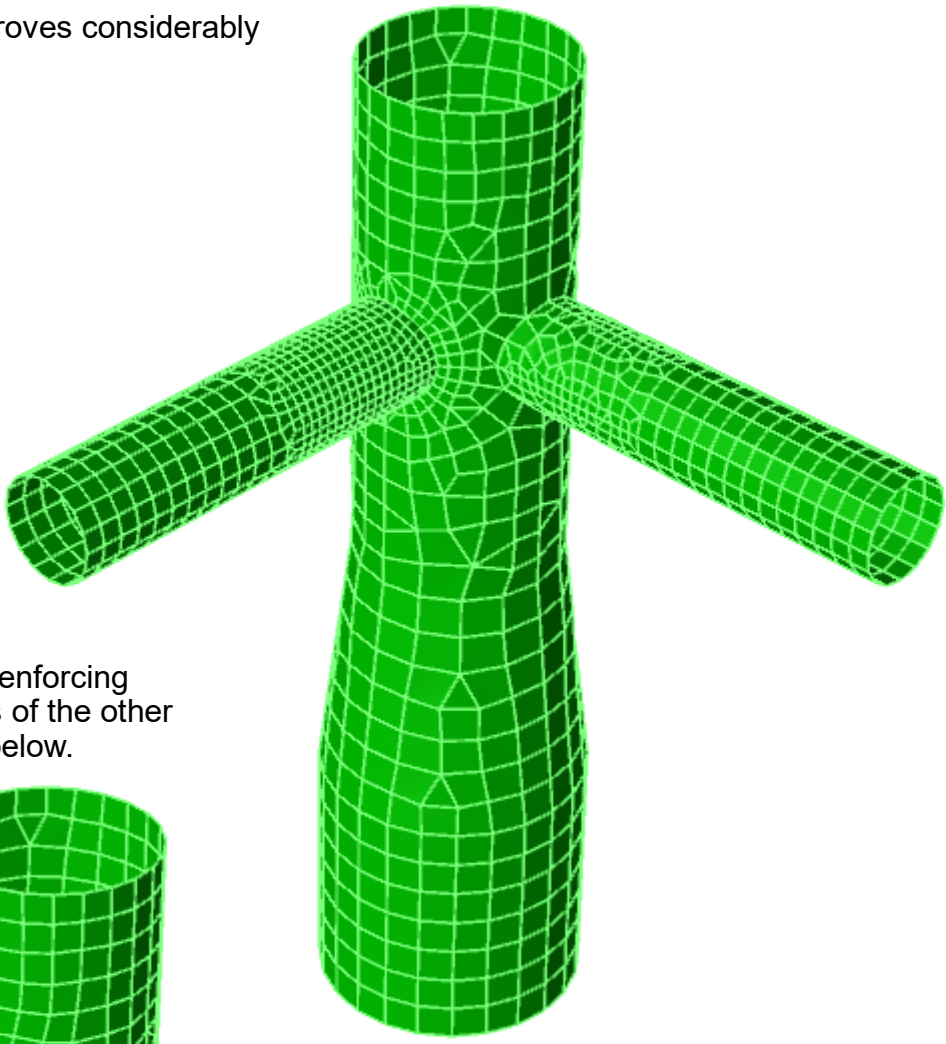


- The reason for the poor quality is that the fine mesh (mesh_100) is restricted by the neighbouring coarser mesh (that was not remeshed).

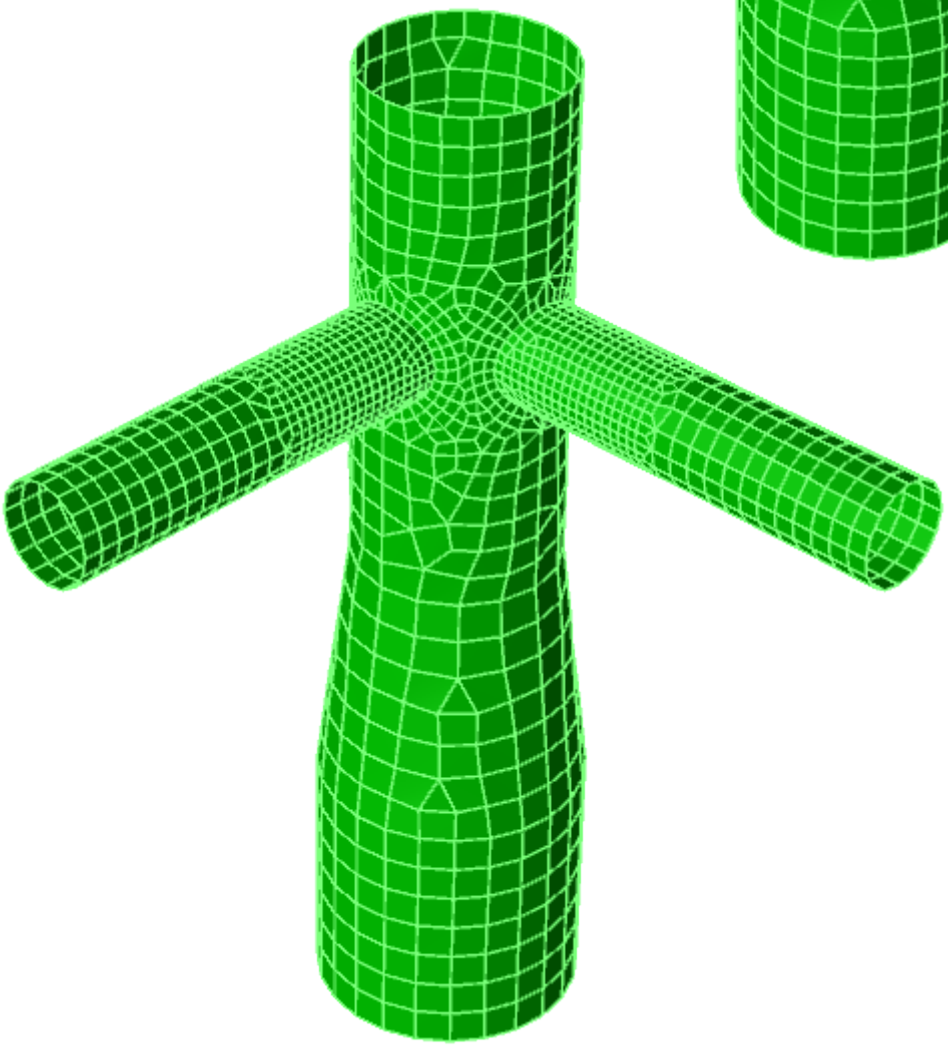
- This can be addressed by enforcing remeshing the surfaces neighbouring a plug as shown.



- The mesh of the stub improves considerably as seen to the right.

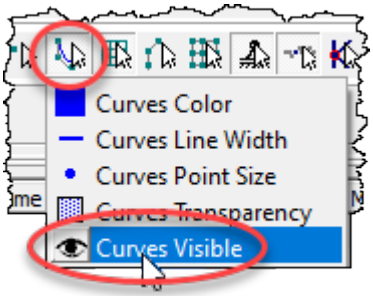


- Repeating the process of enforcing remeshing the neighbours of the other stub produces the result below.

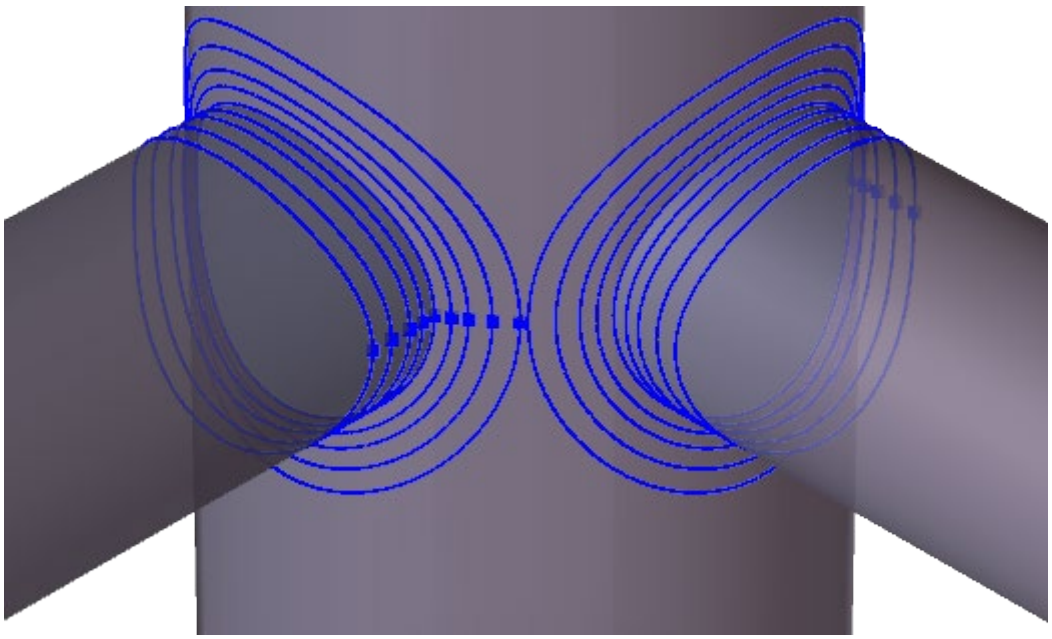


8 FEATURE EDGES FOR CONTROLLING MESH

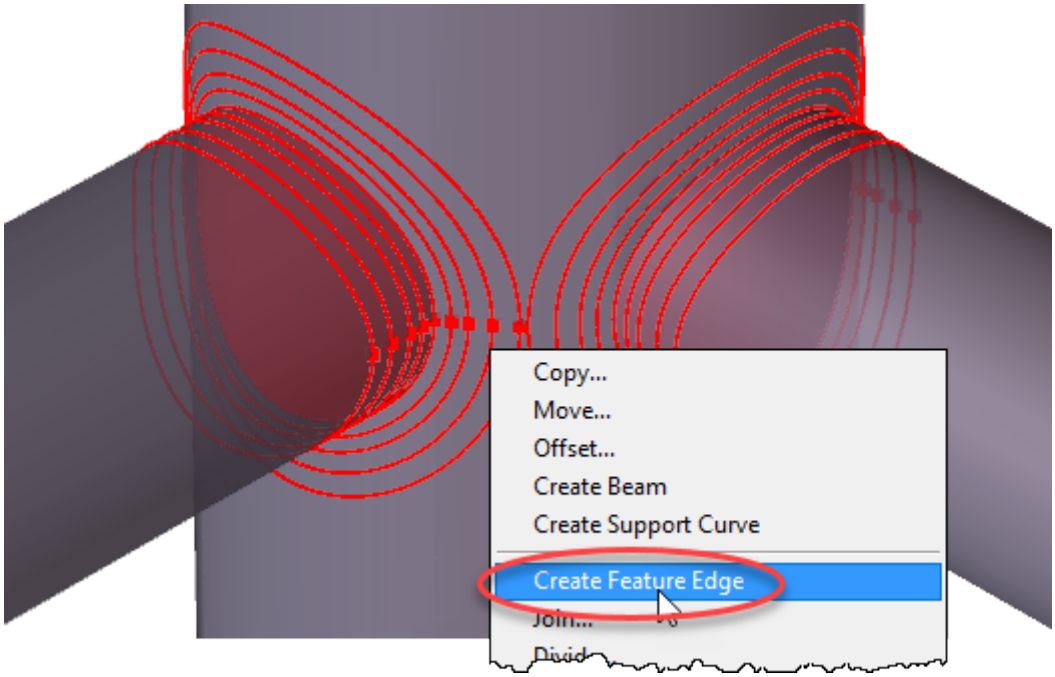
- In addition to internal and external plate topology lines and curves, feature edges may be added to control the mesh.



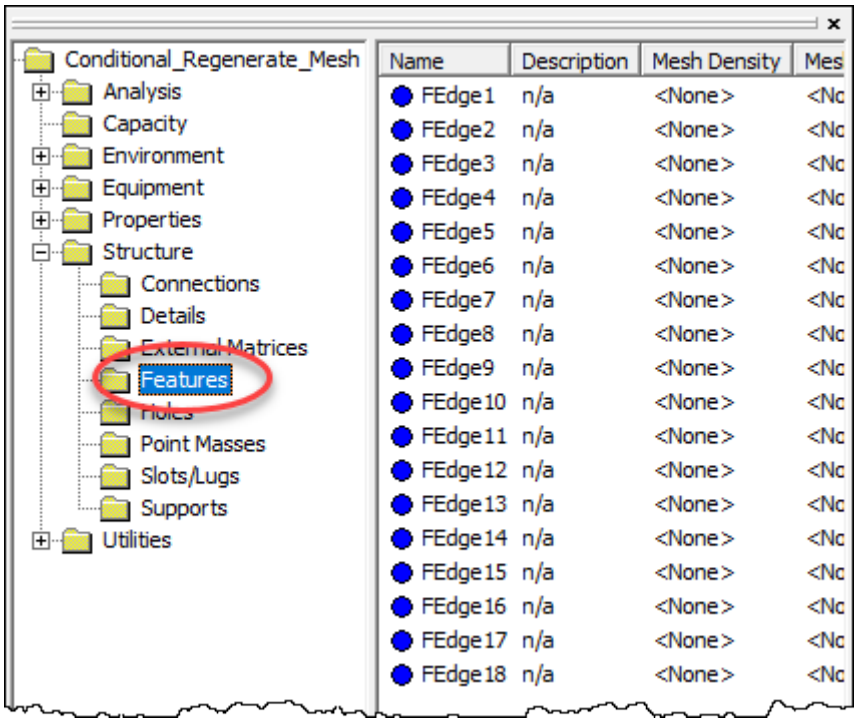
- The imported model includes several guide curves as shown below. These do not by themselves control the mesh.
  - Display the guide curves by e.g. opening the eye symbol for the *Guide curve selection* button as shown to the right.
  - Note that such guide curves are easily created by *Guiding Geometry* | *Curves on Surfaces* | *Plate/Shell Edges' Offsets on the Surface*.



- Select the guide curves, right-click and click *Create Feature Edge* as shown below.

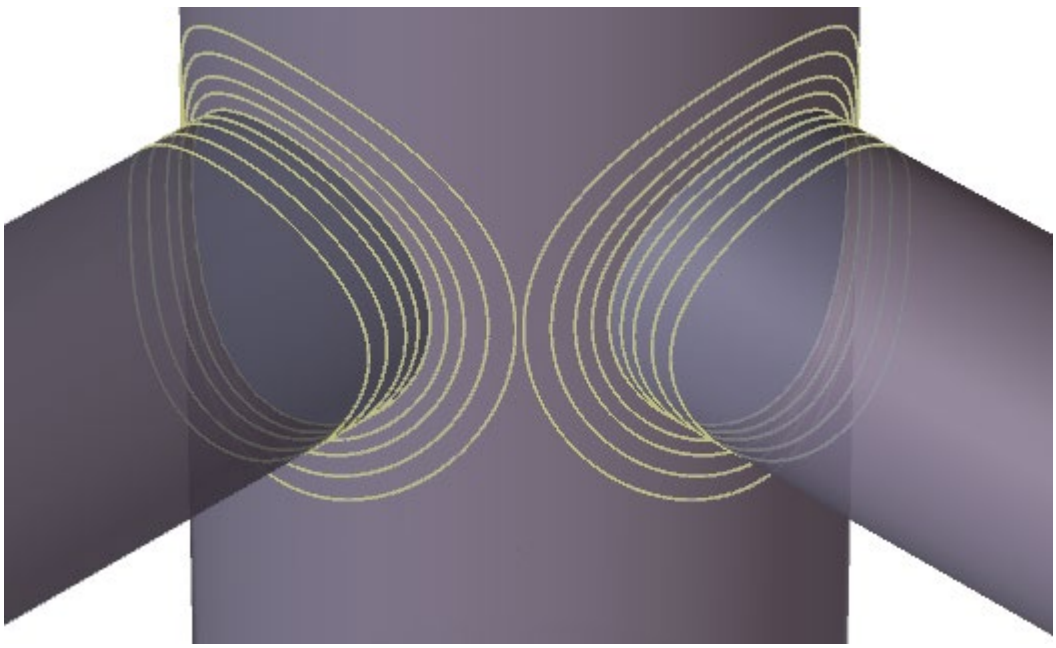


➢ The newly created feature edges are found in the *Structure* | *Features* folder.



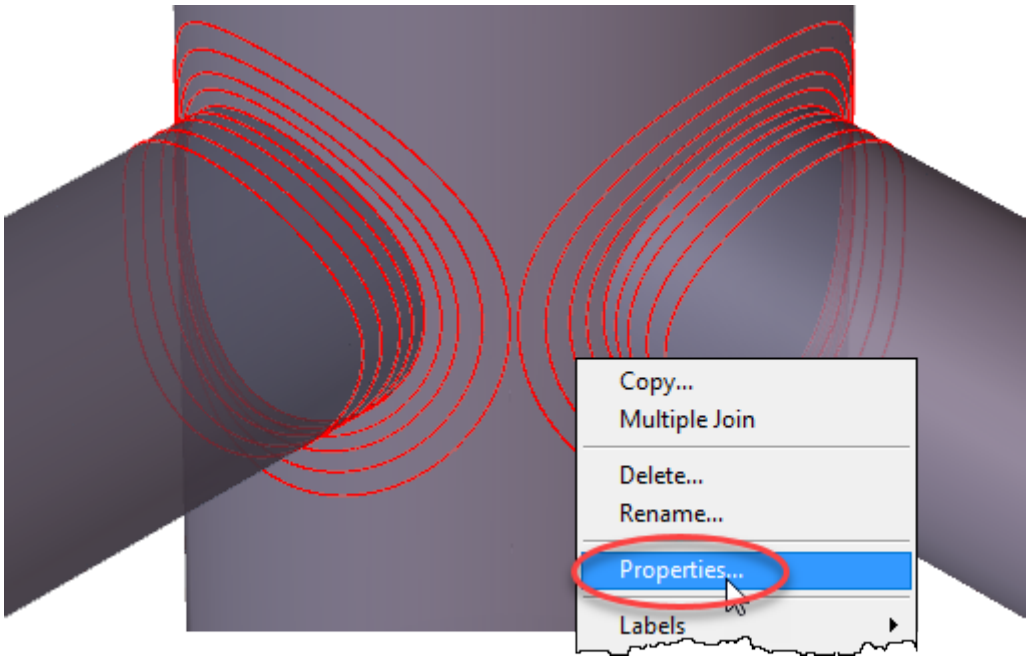
➢ Display the feature edges by opening the eye symbol for the *Featured edge selection* button. Also press the button down to allow their selection.

  - Close the eye symbol for the *Guide curve selection* button to hide these.

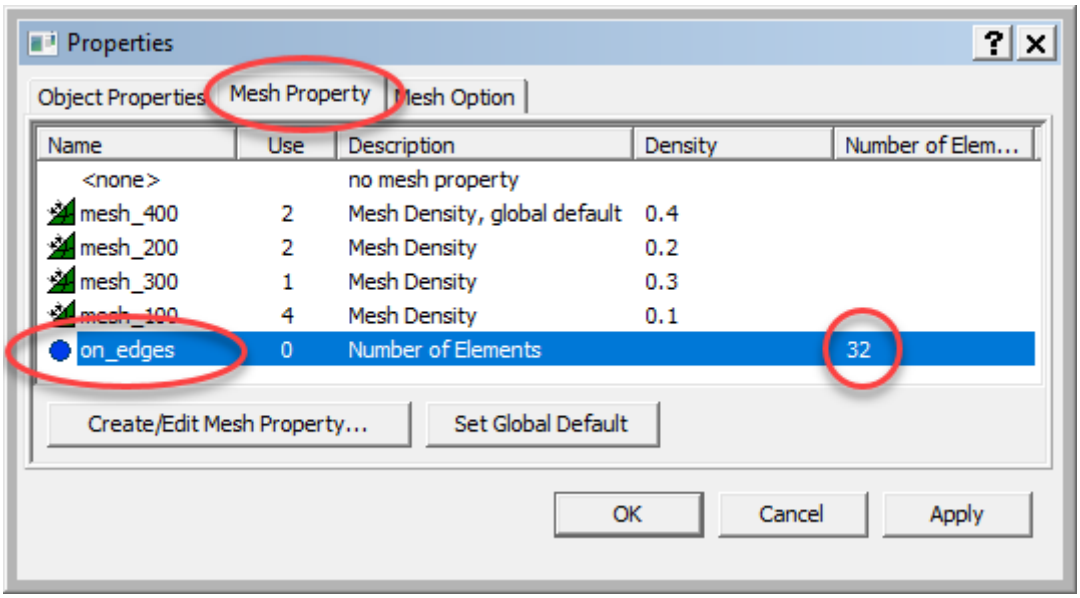


- Select the feature edges.
  - Dragging a rubberband to select them easily selects also the plugs inside the tubular braces, so it may be more convenient to select the feature edges in the browser.

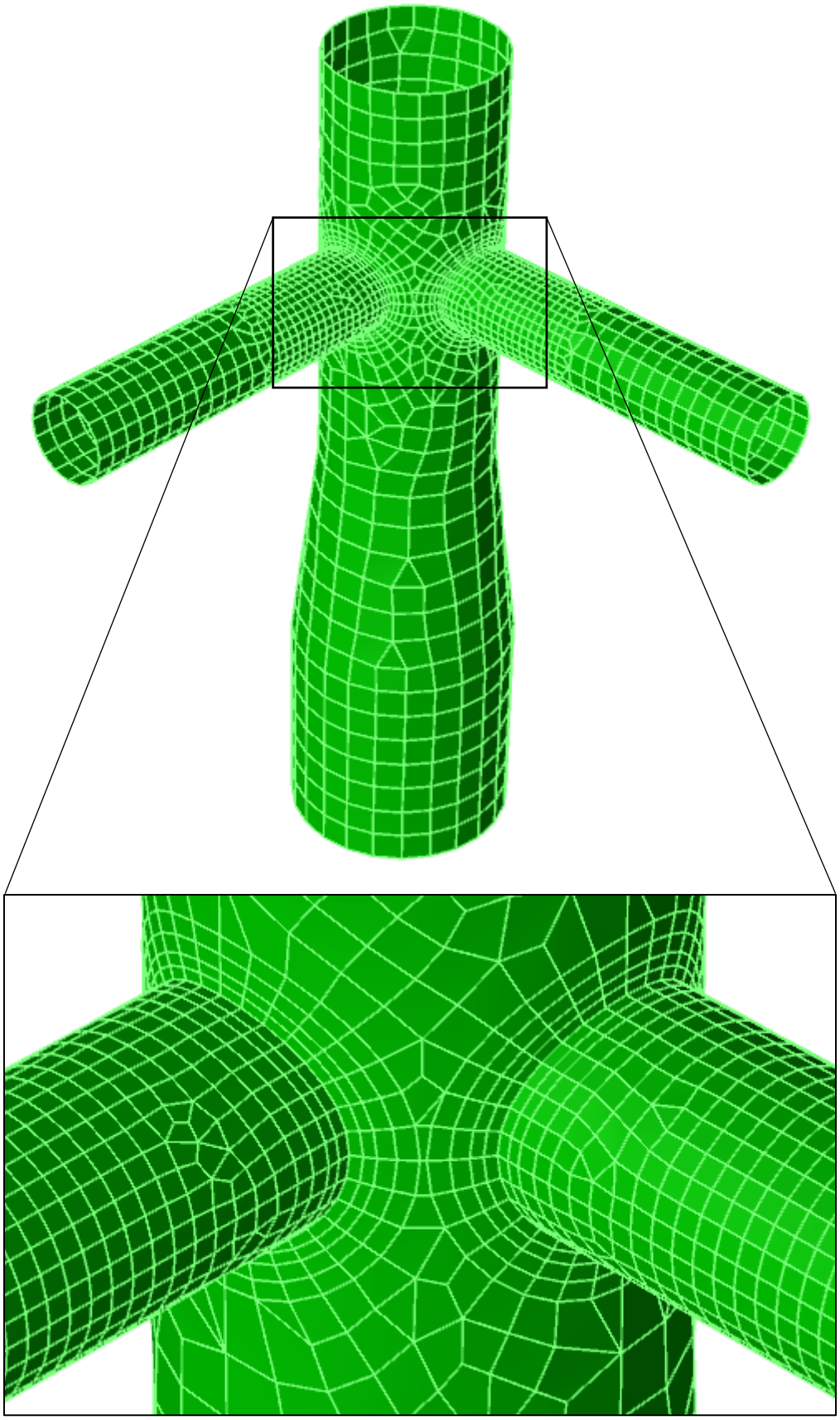
- Right-click and select *Properties*.



- In the *Properties* dialog go to the *Mesh Property* tab and select the property named on_edges thereby assigning this mesh property to the feature edges.
  - Notice that the mesh property involves that there will be 32 elements along the feature edges.



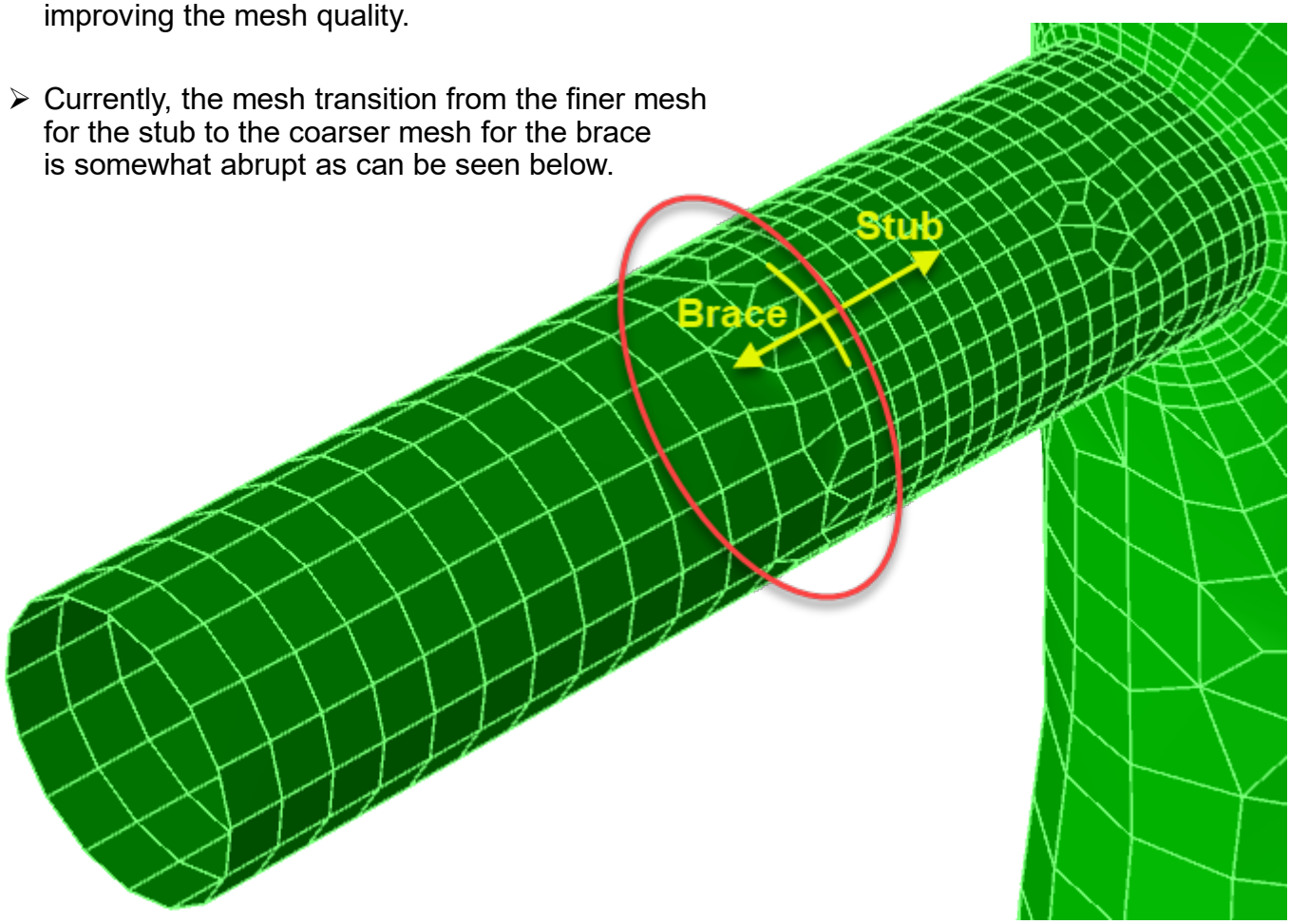
➢ Recreate the FE mesh and see the improvement in the tube intersection area.



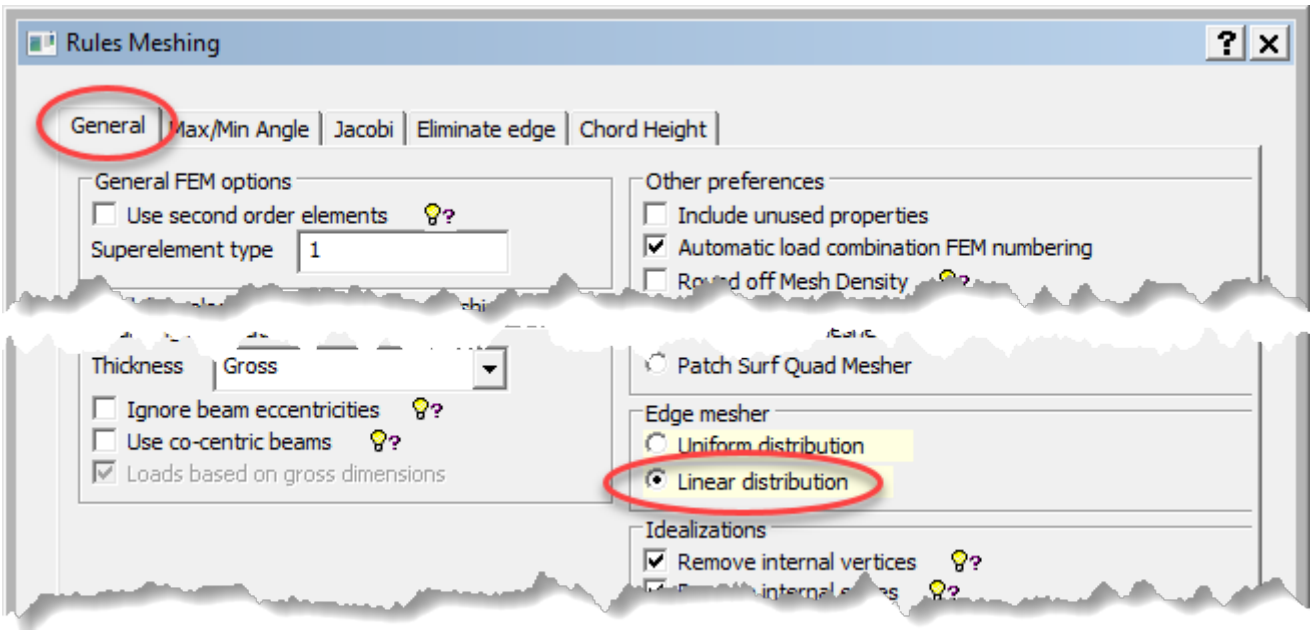
9 SMOOTHER MESH TRANSITION

- The transition from fine to coarse mesh can be made more gradual thereby potentially improving the mesh quality.

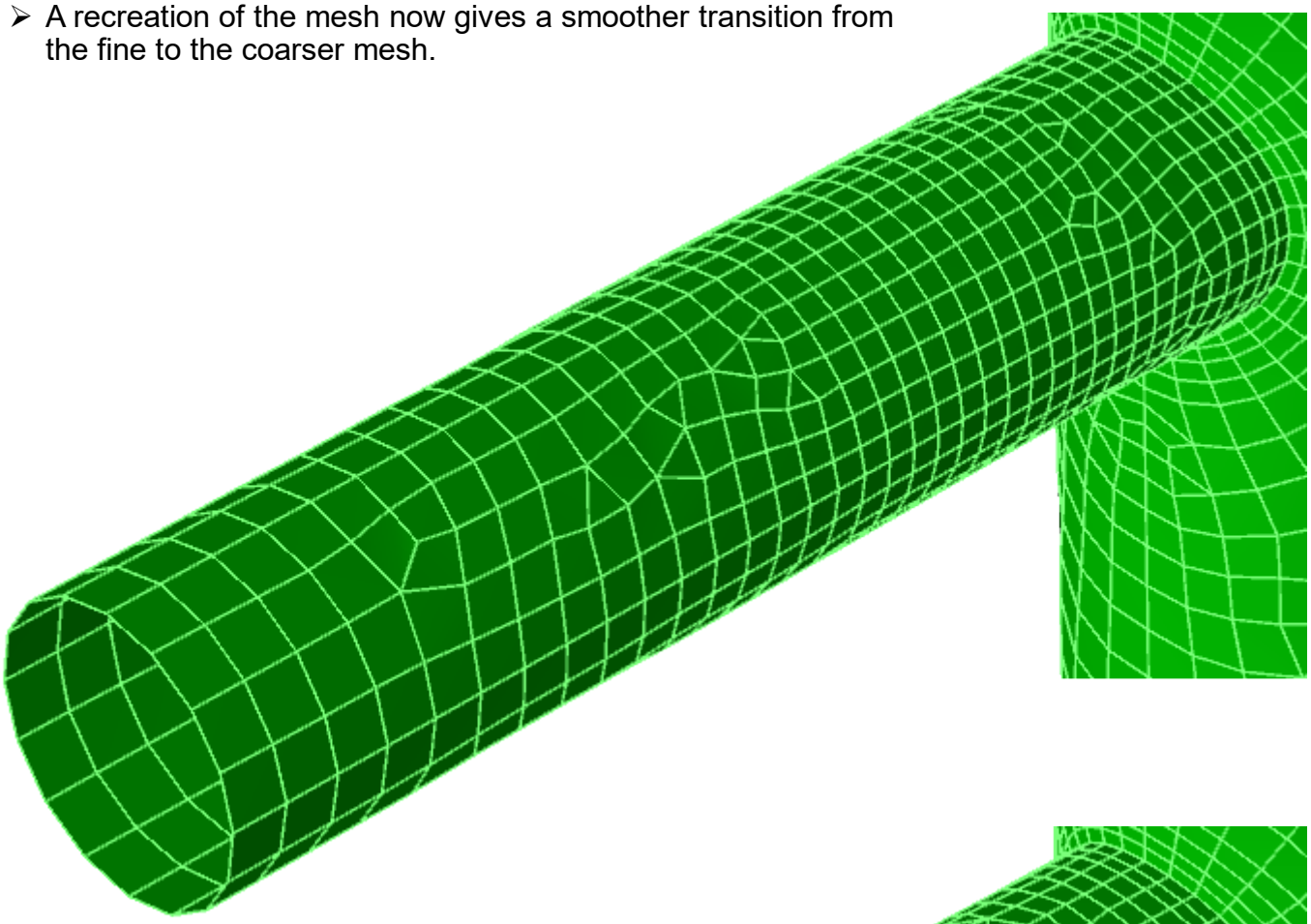
- Currently, the mesh transition from the finer mesh for the stub to the coarser mesh for the brace is somewhat abrupt as can be seen below.



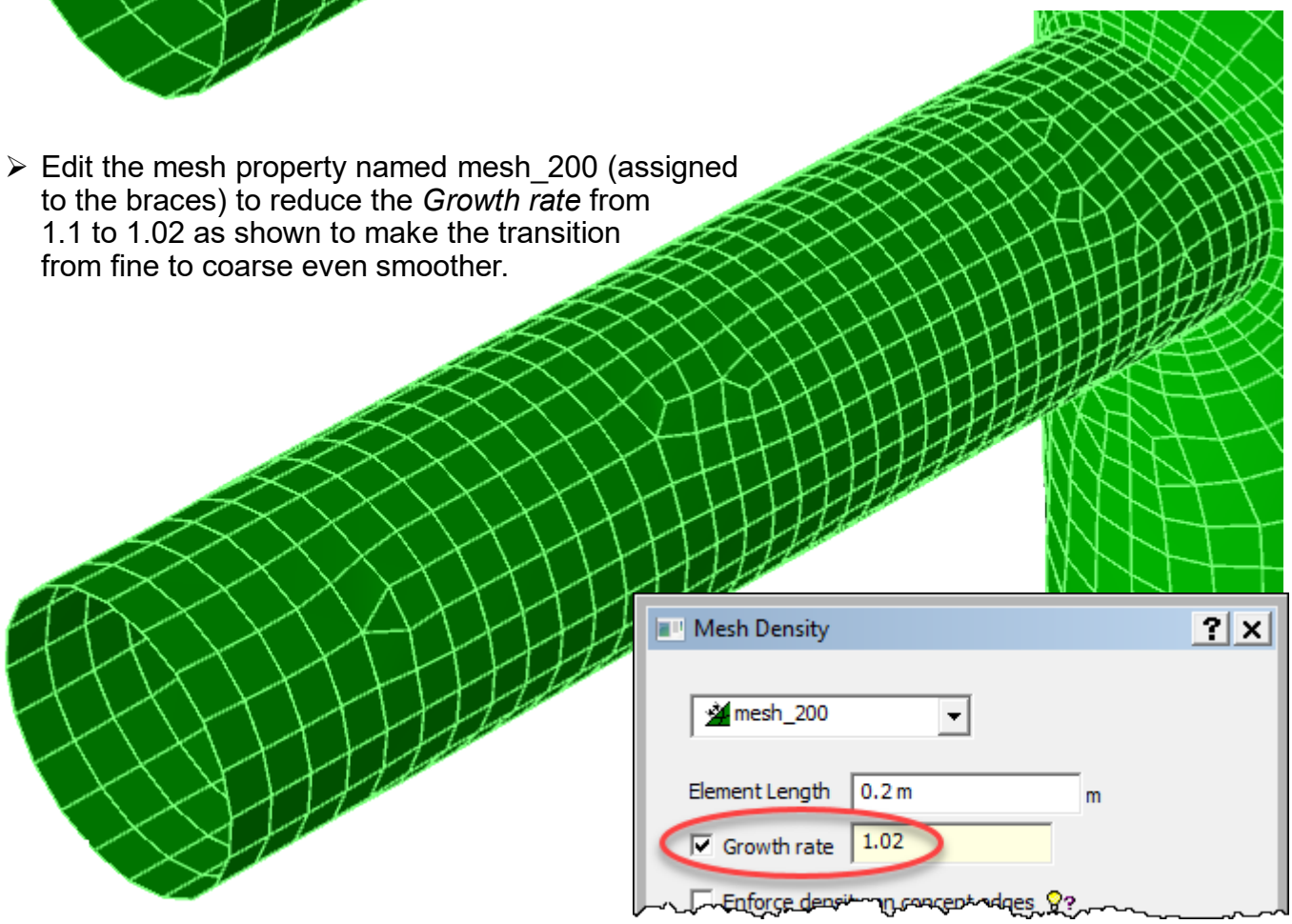
- Use *Edit* | *Rules* | *Meshing Rules* to open the *Rules Meshing* dialog and switch from *Uniform distribution* to *Linear distribution*.



- A recreation of the mesh now gives a smoother transition from the fine to the coarser mesh.

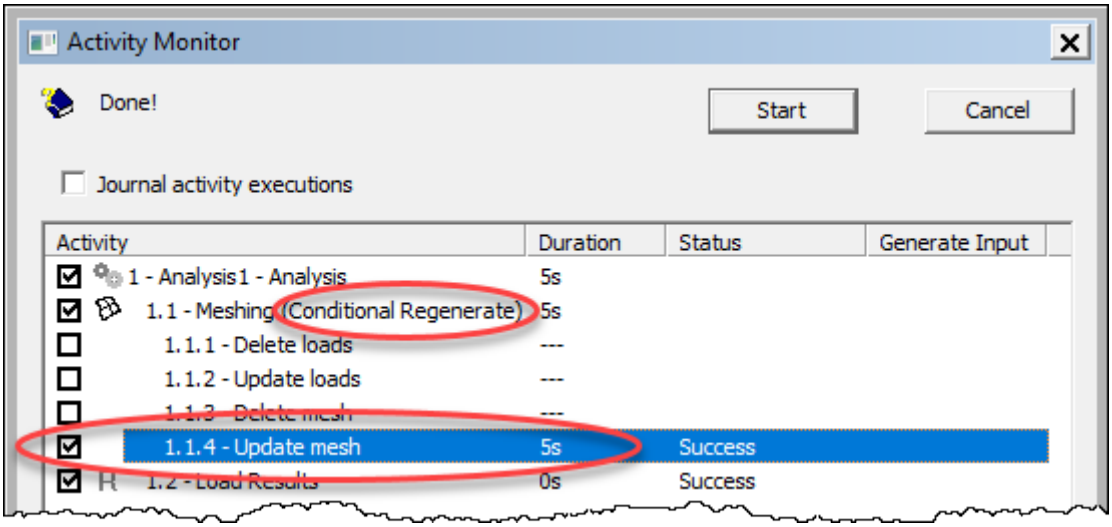


- Edit the mesh property named mesh_200 (assigned to the braces) to reduce the *Growth rate* from 1.1 to 1.02 as shown to make the transition from fine to coarse even smoother.

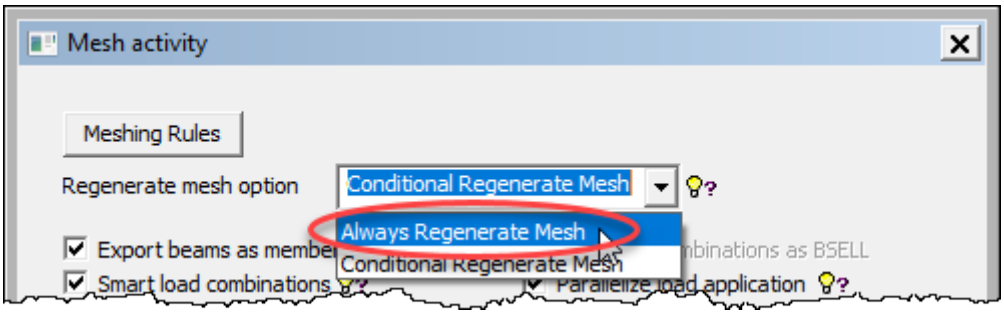


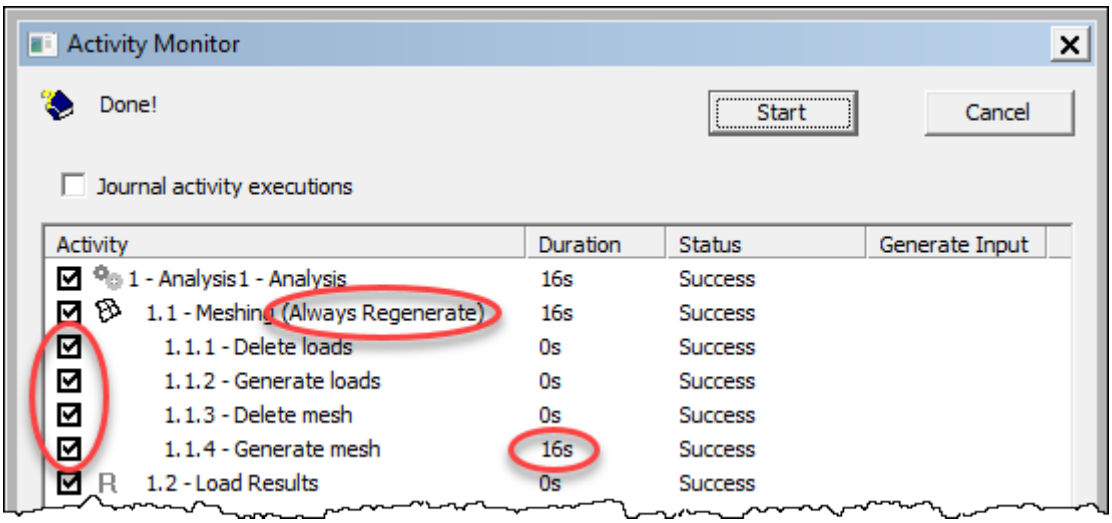
10 TIME SAVING IN CONDITIONAL REGENERATION OF MESH

- The time saving of using *Conditional Regenerate Mesh* can be demonstrated as follows.
  - The last mesh update using *Conditional Regenerate Mesh* required 5 seconds on the computer of the author of this tutorial as seen below.



  - Right-click the meshing activity in the *Activity Monitor* to edit it. Switch back to *Always Regenerate Mesh*.
  - Notice that all sub-activities of the meshing activity have now been checked.
  - Recreate the mesh. The time spent increases from 5 seconds to 16 seconds.
  - For a large model a factor of 3 is of significance.





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