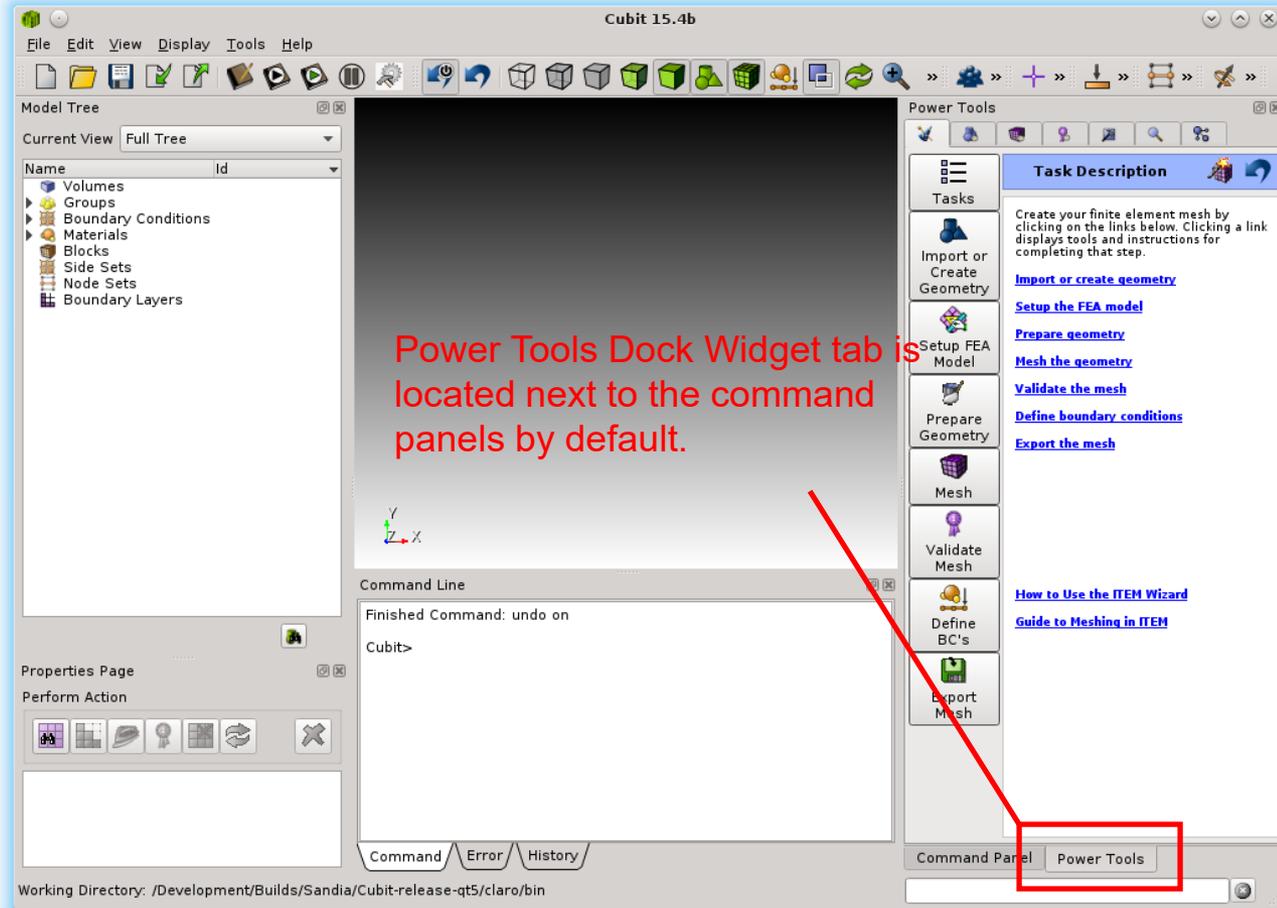


CUBIT Fast-Start Tutorial

7. CUBIT Power Tools

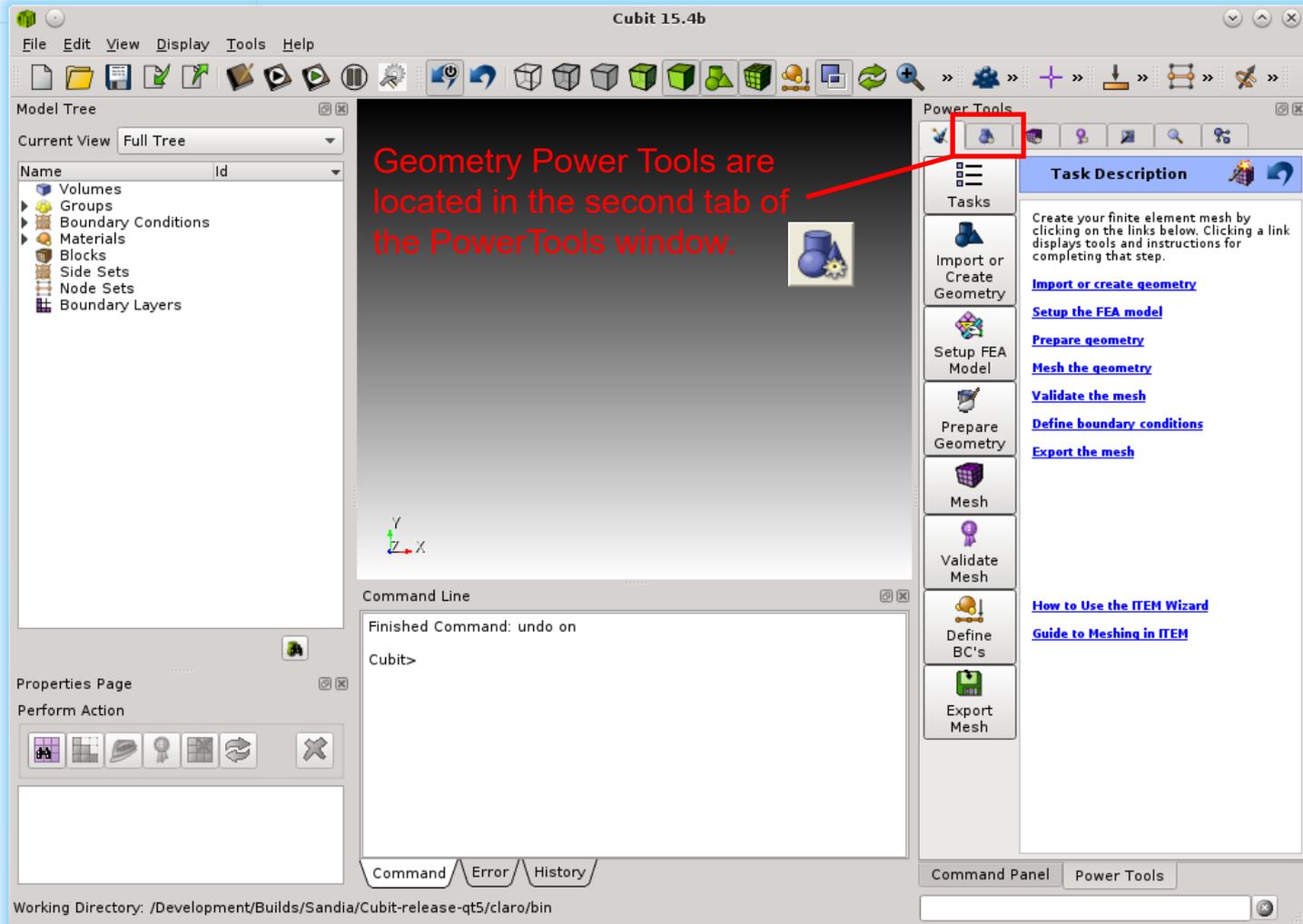
Power Tools

Simulation Modeling Sciences



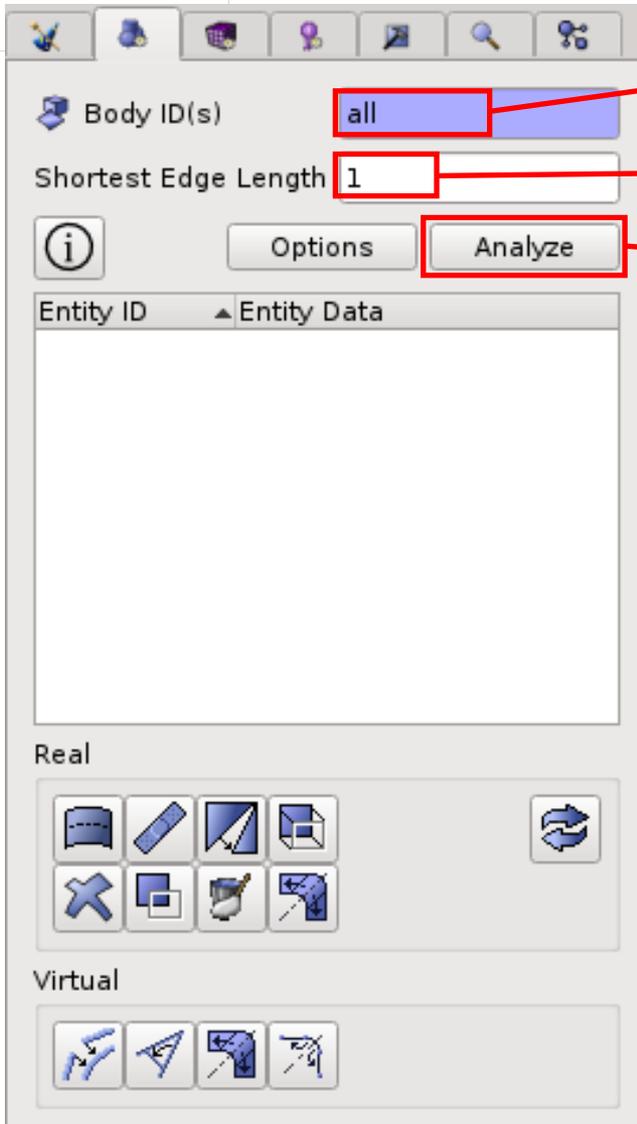
Geometry Power Tools

Simulation Modeling Sciences



The Geometry Power Tools Panel

Simulation Modeling Sciences



Entities to analyze

Characteristic mesh size

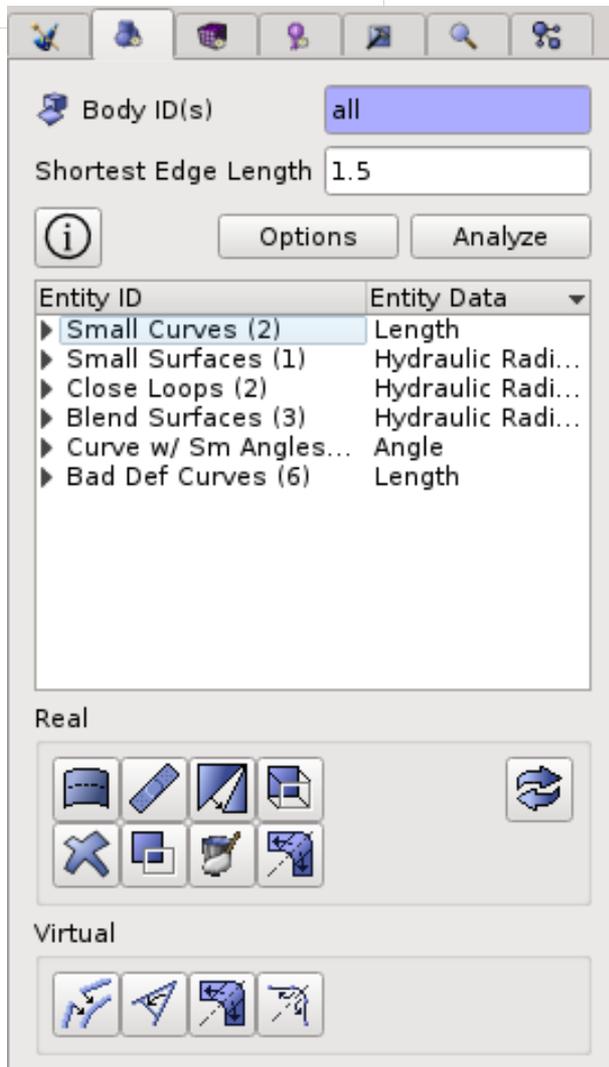
Run geometry analysis

Geometry analysis output

Geometry Operations

Example: Using the Geometry Power tools

Simulation Modeling Sciences

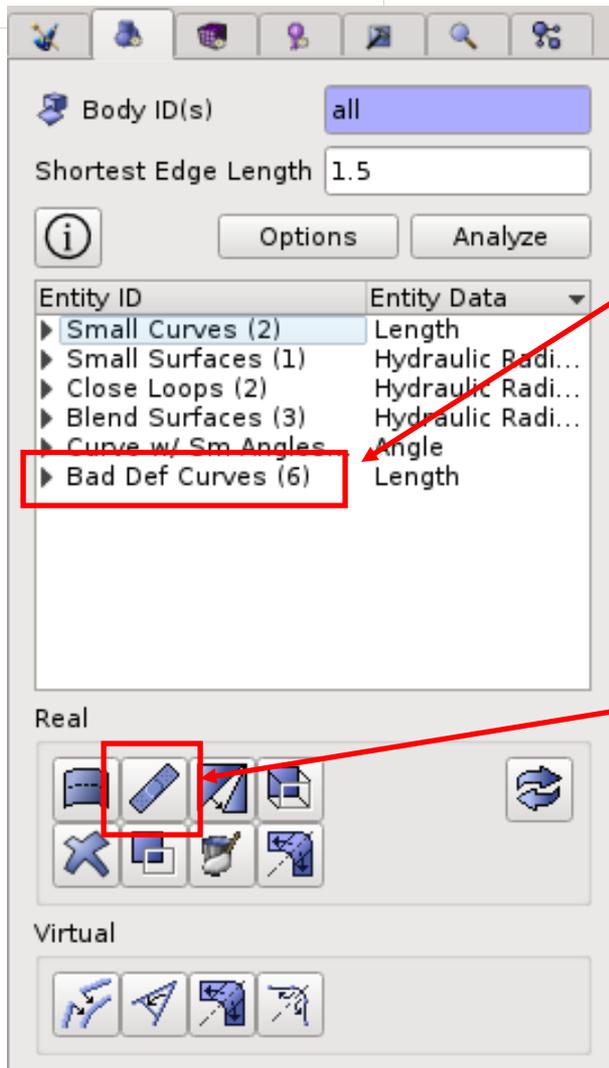


1. Import `knuckle.sat`
2. Select “all” or “1” for volumes to analyze
 - Enter 1.5 as the shortest edge length
 - Hit “Analyze”

You should see results in your output window that look similar to those shown.

Example: Using the Geometry Power tools

Simulation Modeling Sciences

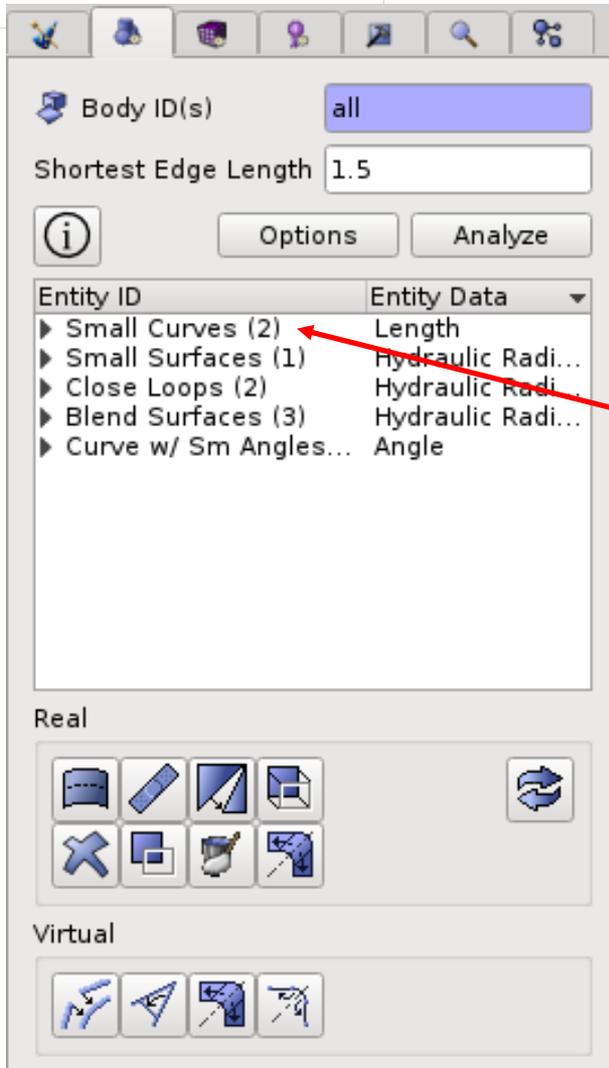


“Bad Def Curves” indicates there is a problem with the geometry definition. These are the most serious problems and should be fixed first.

Fix the geometry problem by running the healer. Hitting this button will bring up the healer dialog in the main command panel.

Example: Using the Geometry Power tools

Simulation Modeling Sciences

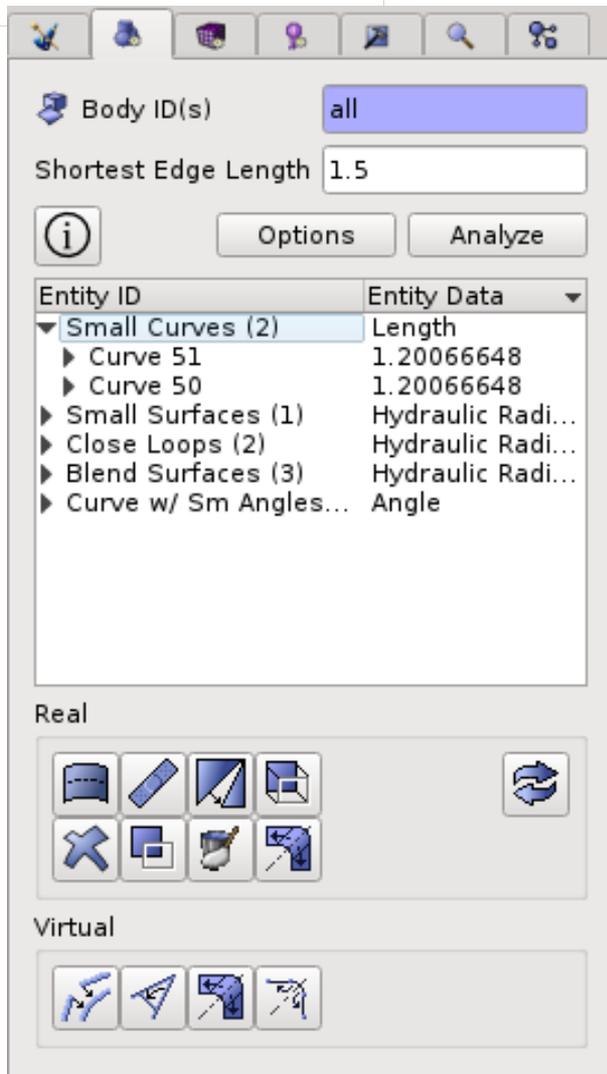


Hit the “Analyze” button again after running autoheal to remove outdated data from the output.

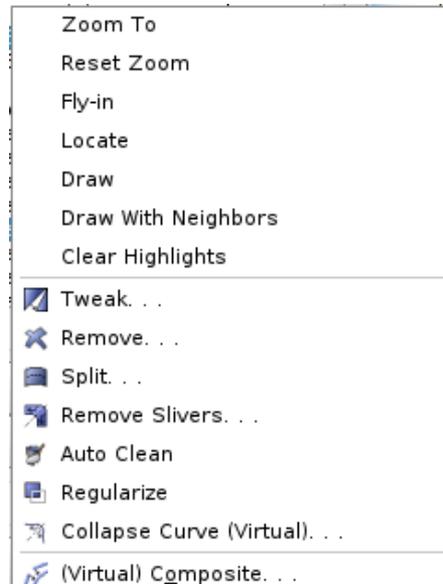
Expand the “Small Curves” field to see the curves that have been found.

Example: Using the Geometry Power Tools

Simulation Modeling Sciences



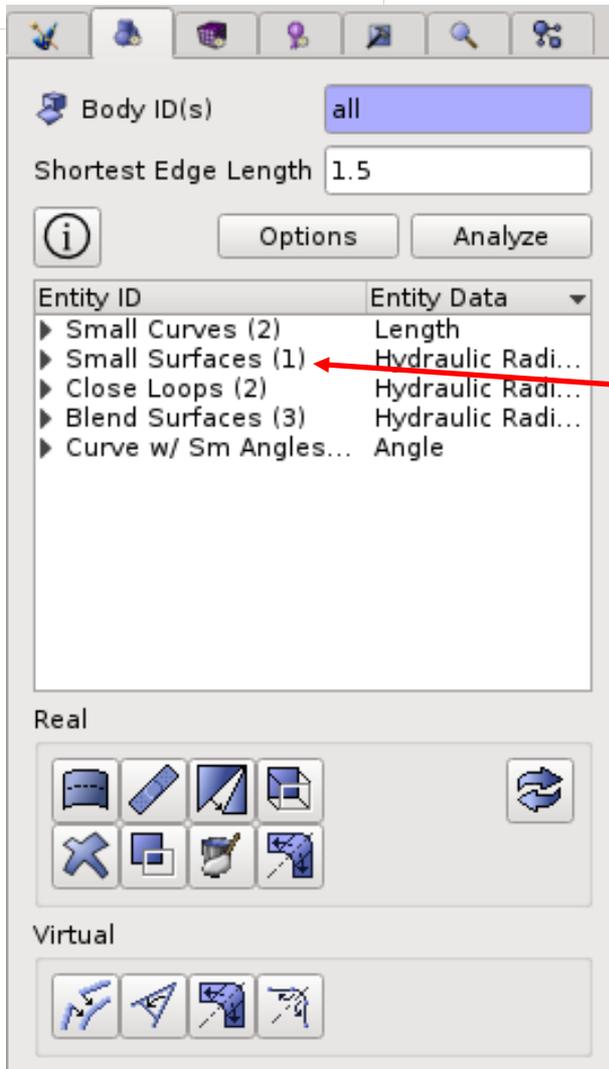
Examine the “Small Curves”. Notice the length of the curves is less than the shortest edge length entered earlier. From the expanded list right click on a curve.



Use the context menu options to examine each curve. Nothing needs to be fixed with these curves.

Example: Using the Geometry Power Tools

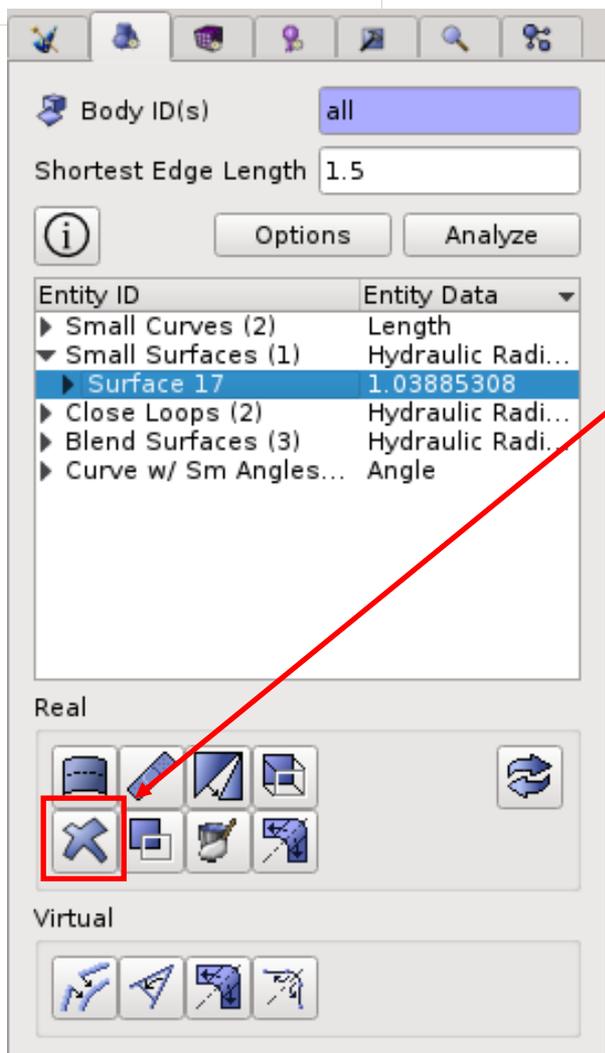
Simulation Modeling Sciences



Expand the “Small Surfaces” field to see the surface that have been found.

Example: Using the Geometry Power Tools

Simulation Modeling Sciences



Examine the surface.

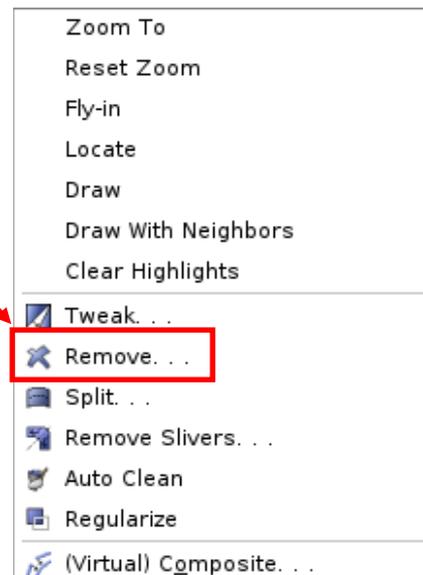
This is a surface we want to remove.

Use the “Remove Entity”
button

- or -

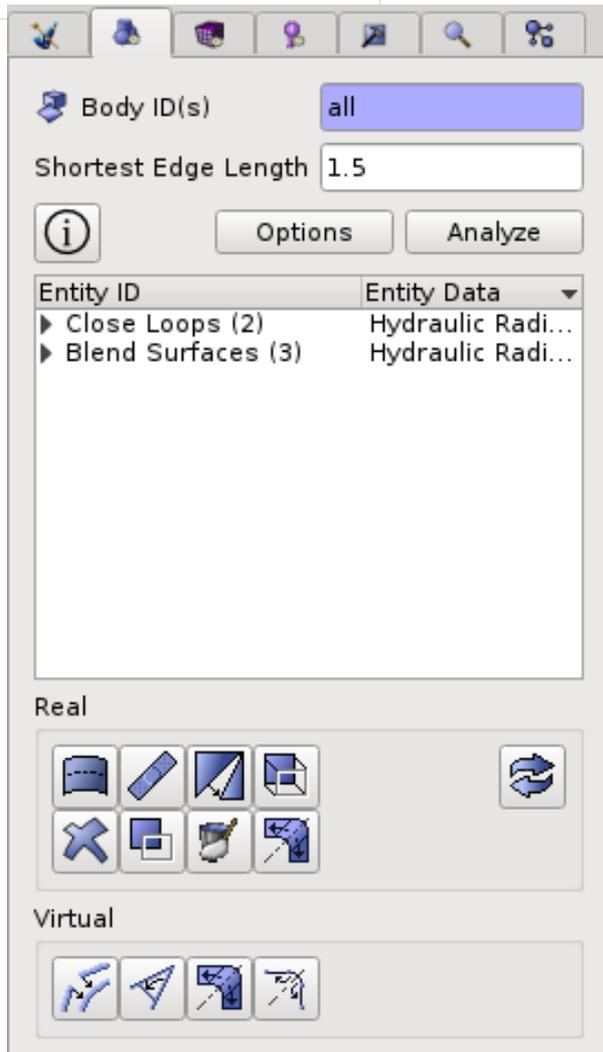
the “Remove” option
from the context menu.

These will bring up the
remove surface dialog in
the main command panel



Example: Using the Geometry Power Tools

Simulation Modeling Sciences



Hit the “Analyze” button again after removing the surface to remove outdated data from the output.

Check the rest of the output and remove anything else that should be remove.

Mesh Power Tool

Simulation Modeling Sciences

The screenshot displays the Cubit 15.4b software interface. The main window is titled "Cubit 15.4b" and features a menu bar (File, Edit, View, Display, Tools, Help) and a toolbar with various icons. On the left, the "Model Tree" panel shows a hierarchical structure of the model, including Volumes, Groups, Boundary Conditions, Materials, Blocks, Side Sets, Node Sets, and Boundary Layers. The central workspace shows a 3D coordinate system with X, Y, and Z axes. Below the workspace is the "Command Line" panel, which displays the text "Finished Command: undo on" and "Cubit>". At the bottom left, the "Properties Page" panel is visible, showing a "Perform Action" section with several icons. On the right side, the "Power Tools" panel is open, displaying a list of tasks: "Import or Create Geometry", "Setup FEA Model", "Prepare Geometry", "Mesh", "Validate Mesh", "Define BC's", and "Export Mesh". A red box highlights the "Mesh" task icon, which is a purple cube. A red arrow points from the text "Mesh Power Tools are located on the Entity Tree window under the purple tab." to this icon. The "Task Description" panel on the right provides instructions for creating a finite element mesh and lists several links: "Import or create geometry", "Setup the FEA model", "Prepare geometry", "Mesh the geometry", "Validate the mesh", "Define boundary conditions", "Export the mesh", "How to Use the ITEM Wizard", and "Guide to Meshing in ITEM". The "Command Panel" at the bottom right shows "Command Panel" and "Power Tools" tabs.

Mesh Power Tools are located on the Entity Tree window under the purple tab.

Task Description

Create your finite element mesh by clicking on the links below. Clicking a link displays tools and instructions for completing that step.

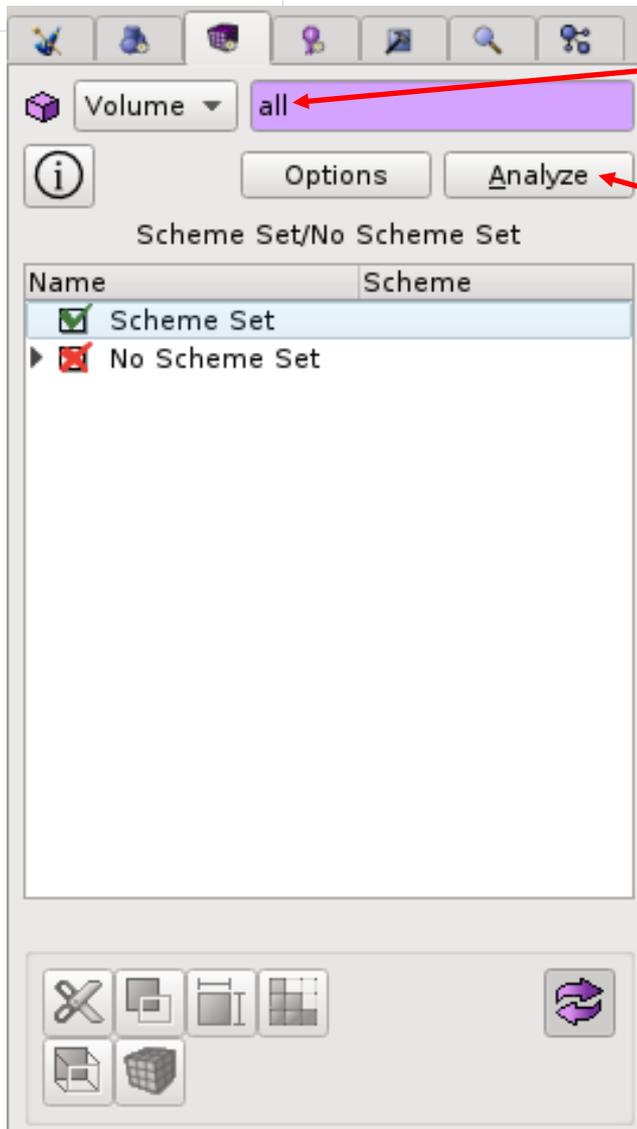
- [Import or create geometry](#)
- [Setup the FEA model](#)
- [Prepare geometry](#)
- [Mesh the geometry](#)
- [Validate the mesh](#)
- [Define boundary conditions](#)
- [Export the mesh](#)

[How to Use the ITEM Wizard](#)

[Guide to Meshing in ITEM](#)

The Mesh Power Tool Panel

Simulation Modeling Sciences



Entities to analyze

Run scheme analysis

Scheme analysis output

Tools for working on model

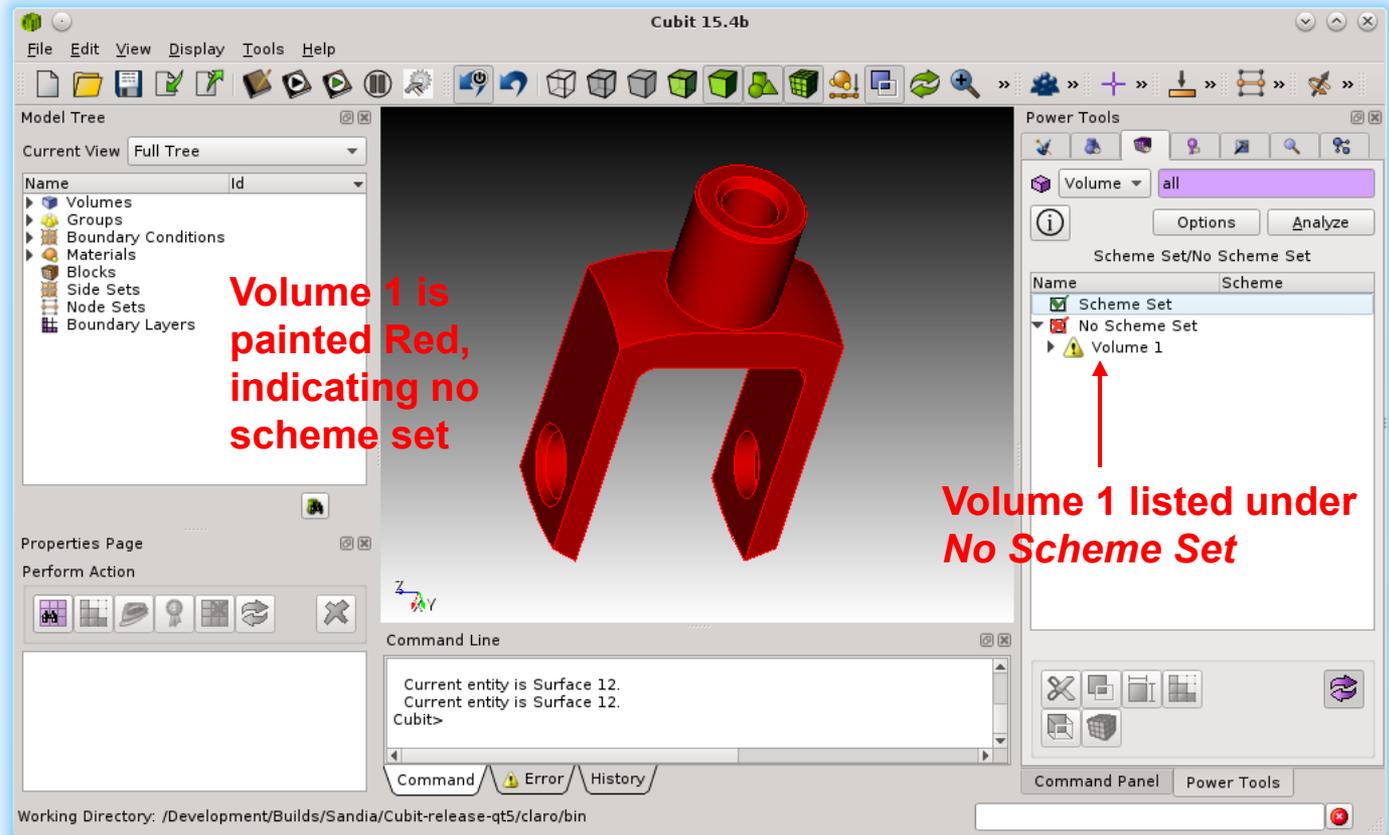
Example: Using the Mesh Power tools

Simulation Modeling Sciences

Run the scheme analysis on `knuckle.sat` after cleaning up geometry but before doing any decomposition.

Results are displayed in two ways

1. Listed in the power tool window
2. Displayed Graphically

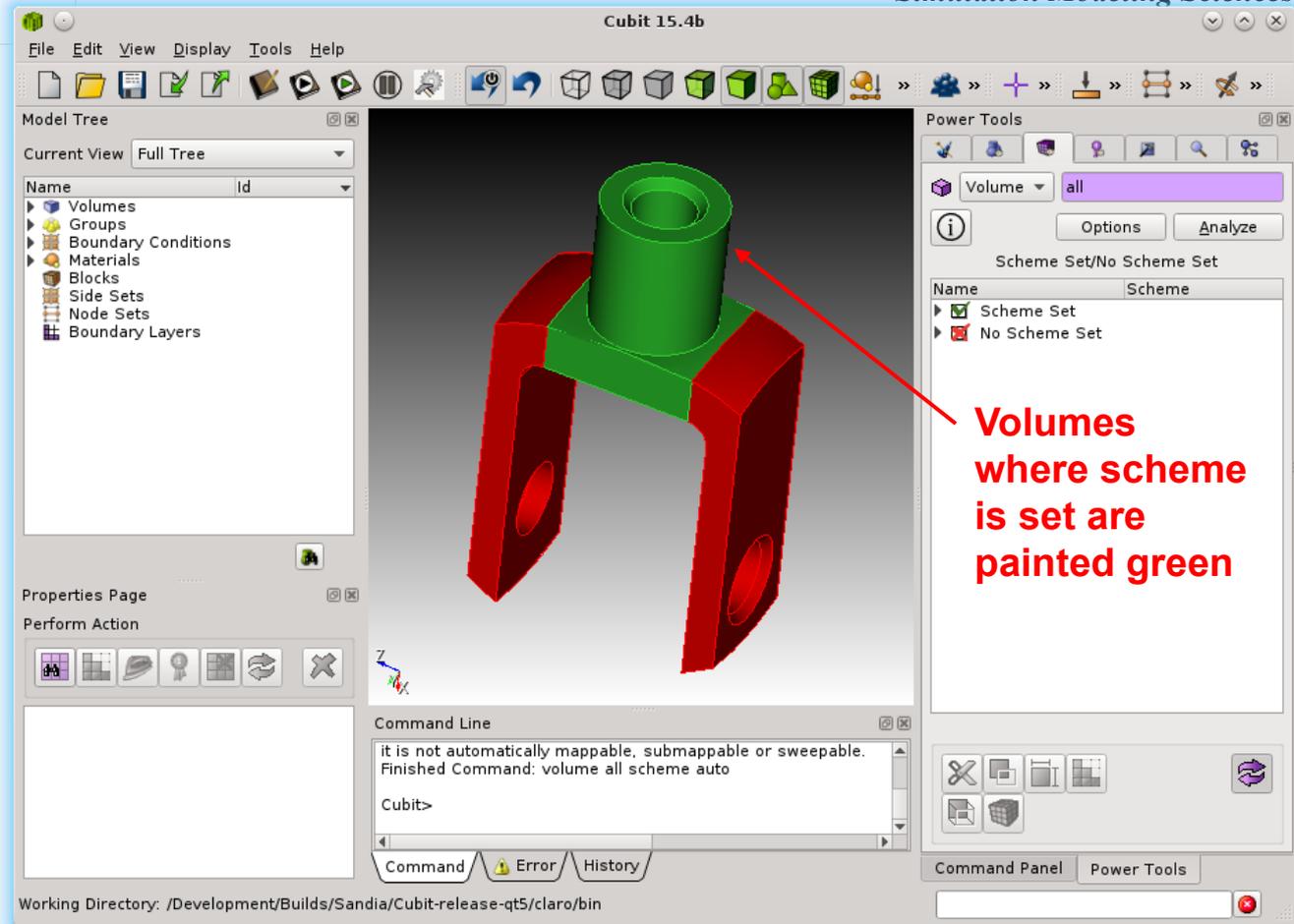


Example: Using the Mesh Power tools

Simulation Modeling Sciences

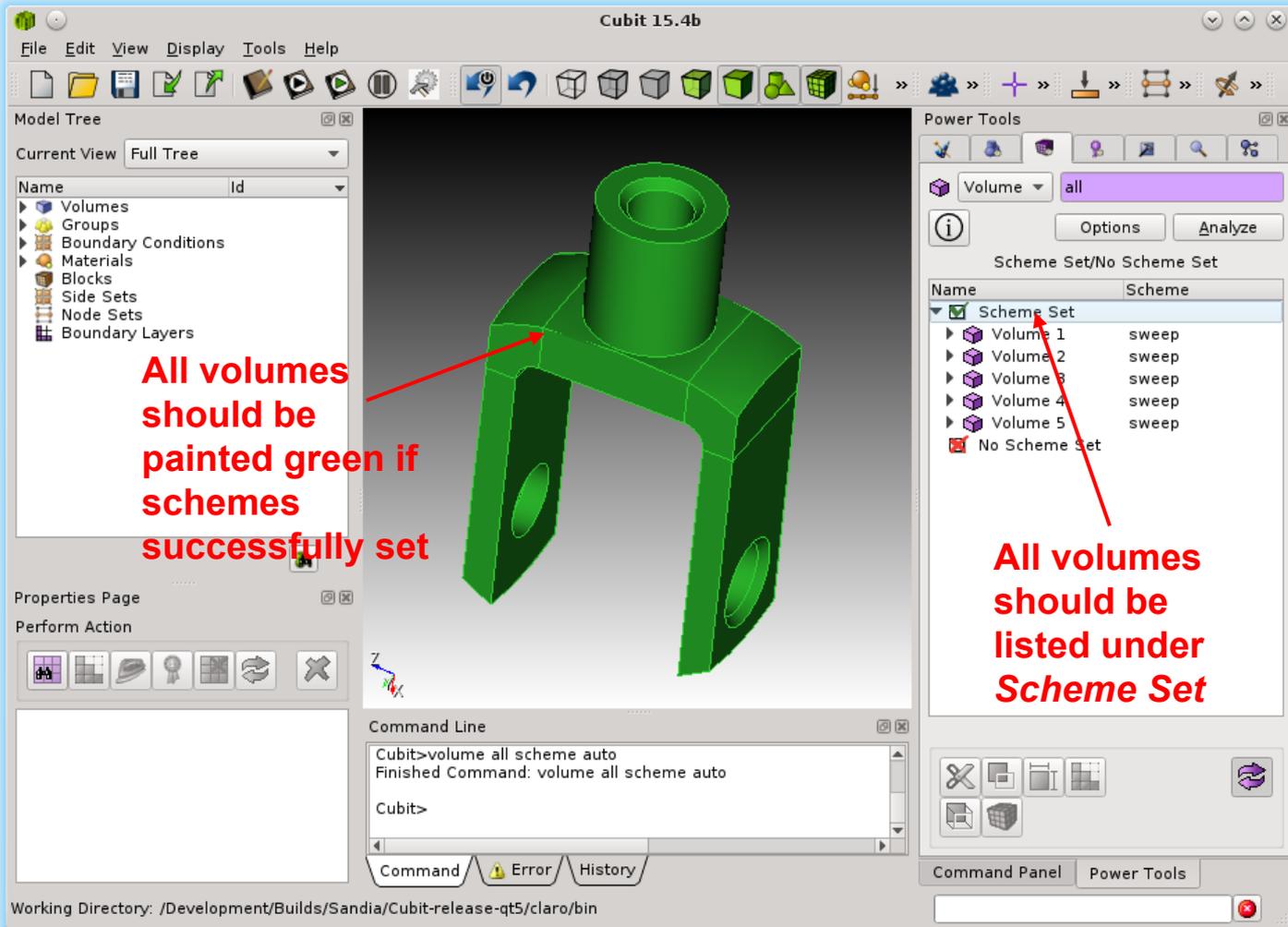
Begin the decomposition process you did in Exercise 13. After each webcut, run the analysis again to check meshability

Note when a volume moves to the *Scheme Set* category



Example: Using the Mesh Power tools

Simulation Modeling Sciences



Complete the decomposition

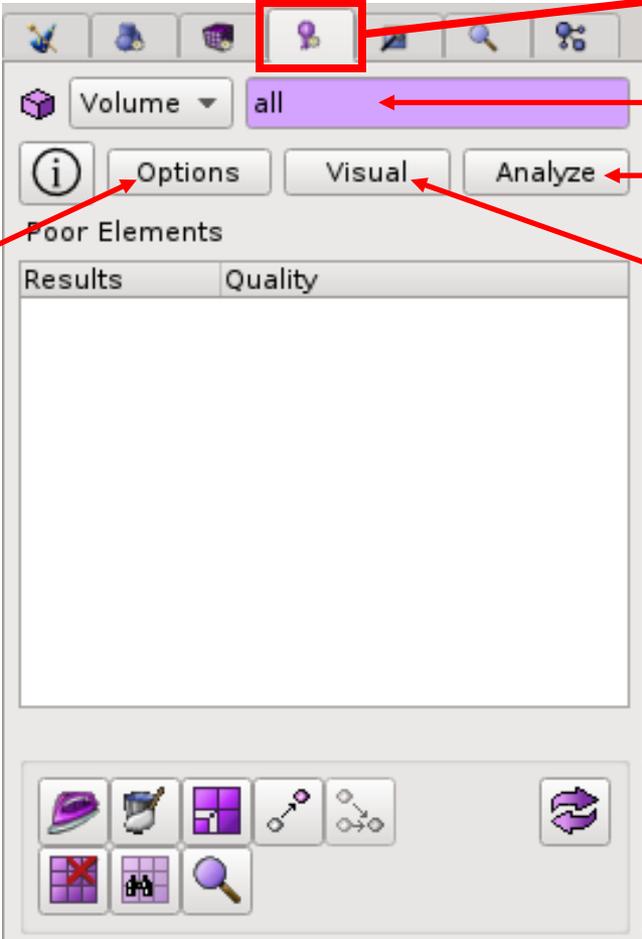
Run imprint and merge

Run the analysis again

Mesh the parts

The Mesh Quality Power Tool

Simulation Modeling Sciences



Hit the quality Tab  to display the Mesh Quality Power Tool

Entities to analyze

Run mesh quality analysis

Display additional mesh quality visualization options

Mesh Quality analysis output

Tools for improving element quality

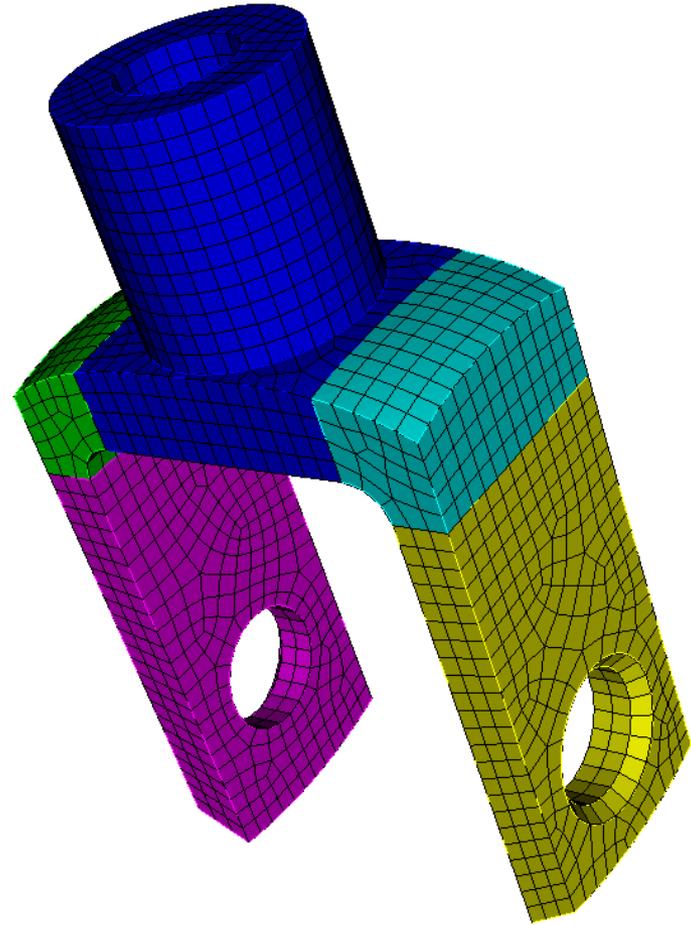
Select Metrics to use during analysis

The screenshot shows the Mesh Quality Power Tool interface. At the top, there is a toolbar with several icons; the quality icon (a purple cube with a white dot) is highlighted with a red box and an arrow pointing to the text 'Hit the quality Tab...'. Below the toolbar, there is a 'Volume' dropdown menu set to 'all', with an arrow pointing to it from the text 'Entities to analyze'. To the right of the 'Volume' dropdown are three buttons: 'Options', 'Visual', and 'Analyze'. An arrow points from the text 'Run mesh quality analysis' to the 'Analyze' button. Below these buttons is a section titled 'Poor Elements' with a sub-section 'Results' and a 'Quality' column. An arrow points from the text 'Display additional mesh quality visualization options' to the 'Visual' button. Below the 'Results' section is a large empty area, with a bracket pointing to it from the text 'Mesh Quality analysis output'. At the bottom of the interface is a toolbar with several icons for improving element quality, with a bracket pointing to it from the text 'Tools for improving element quality'. On the left side, there is a text box 'Select Metrics to use during analysis' with an arrow pointing to the 'Options' button.

Example: Mesh Quality Power Tool

Simulation Modeling Sciences

- Reset CUBIT
- Import the cub file:
knuckle.cub
- Or use the meshed
knuckle model from the
previous exercise



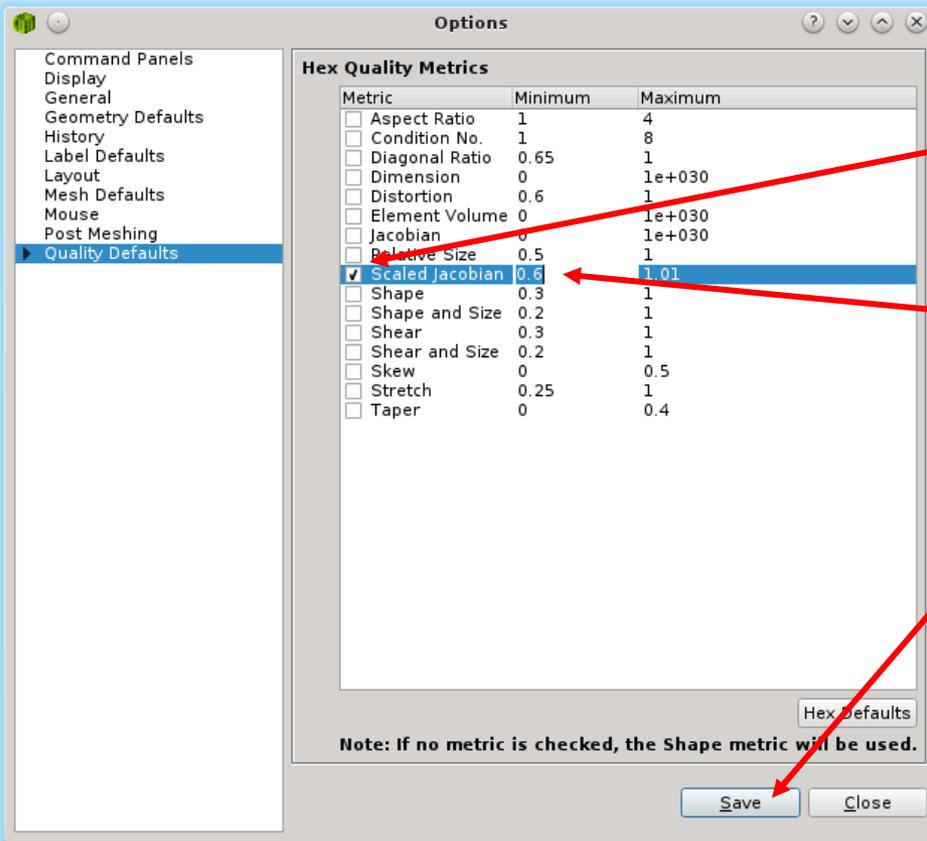
Example: Mesh Quality Power Tool

Simulation Modeling Sciences

- Select the Options Box
The Options Dialog should appear
- Check the Scaled Jacobian Metric
- Change the minimum value to 0.6 (Hit Return)
- Click Save

The Quality Power Tool will show results for all checked metrics

The Quality Power Tool displays results for all elements falling below the minimum

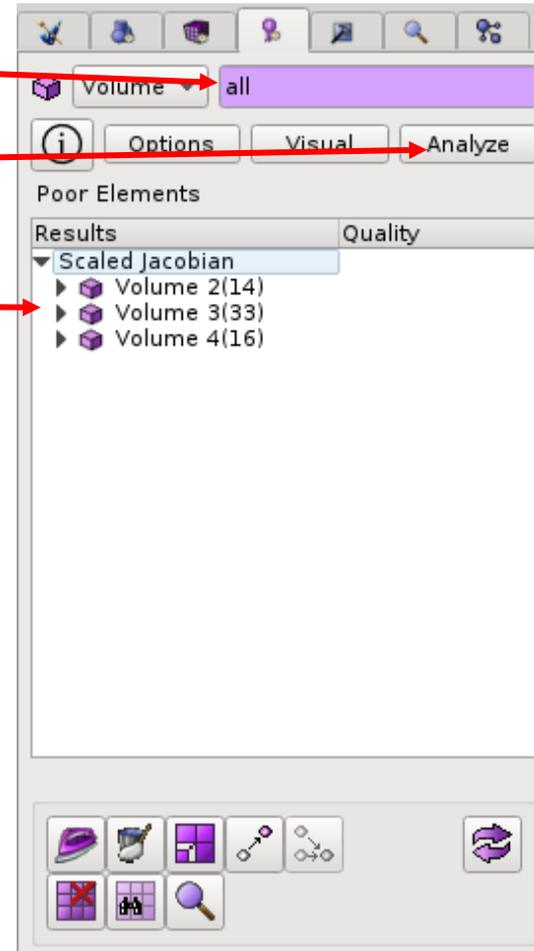


Example: Mesh Quality Power Tool

Simulation Modeling Sciences

- Enter “all” in the edit field
- Hit the Analyze Button
- Drop down the list under Scaled Jacobian

List shows all Volumes where at least one element has Scaled Jacobian < 0.6

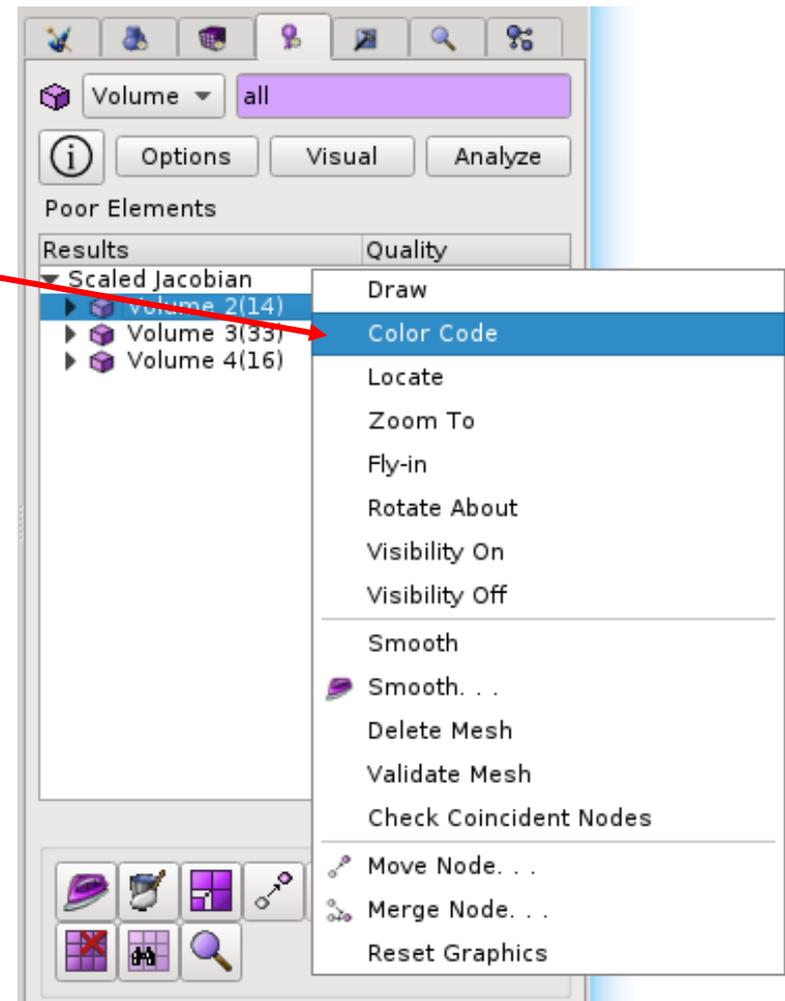
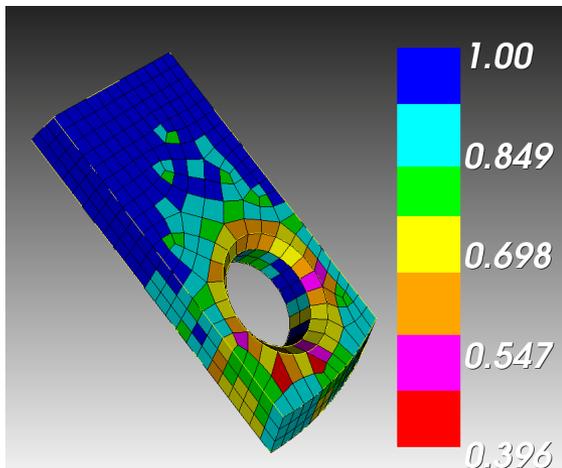


Example: Mesh Quality Power Tool

Simulation Modeling Sciences

- Right Click on the first volume in the list and select Color Code

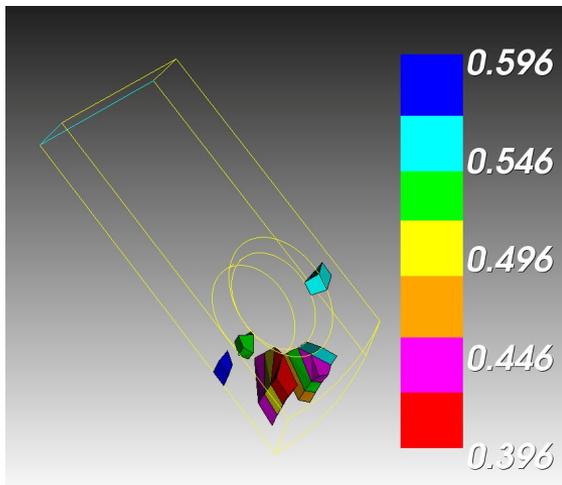
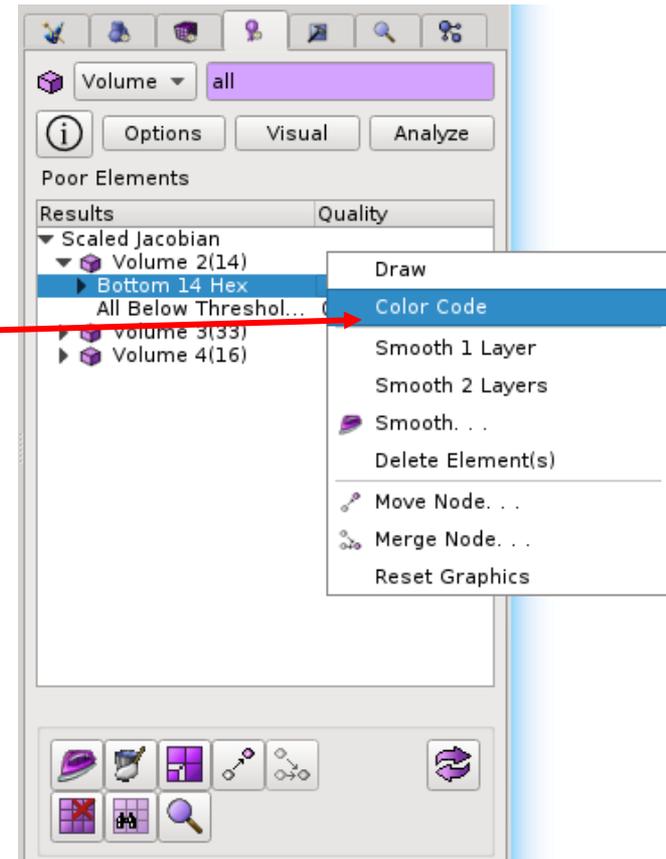
Color Code displays the elements in the selected volume, colored according to their Scaled Jacobian Value



Example: Mesh Quality Power Tool

Simulation Modeling Sciences

- Drop down the list under Volume 2
- Right click on the first line in the list and select Color Code



Color Code in this case displays only the elements in volume 2 falling below the 0.6 minimum Scaled Jacobian Metric

Example: Mesh Quality Power Tool

Simulation Modeling Sciences

Try to improve the mesh quality by removing the chamfers on volumes 2 and 3.

First delete the mesh, remove the chamfers and then remesh. How does the element quality improve? Check your result with the Mesh Quality Power Tool.

