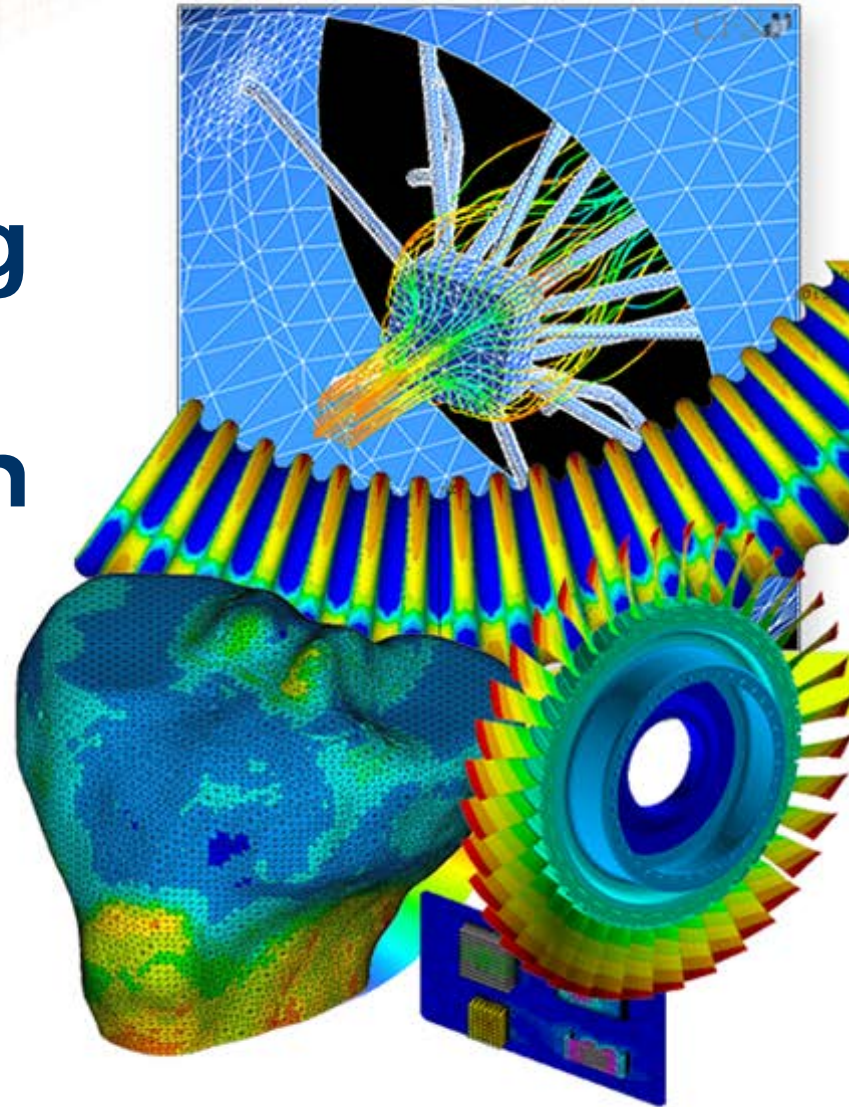
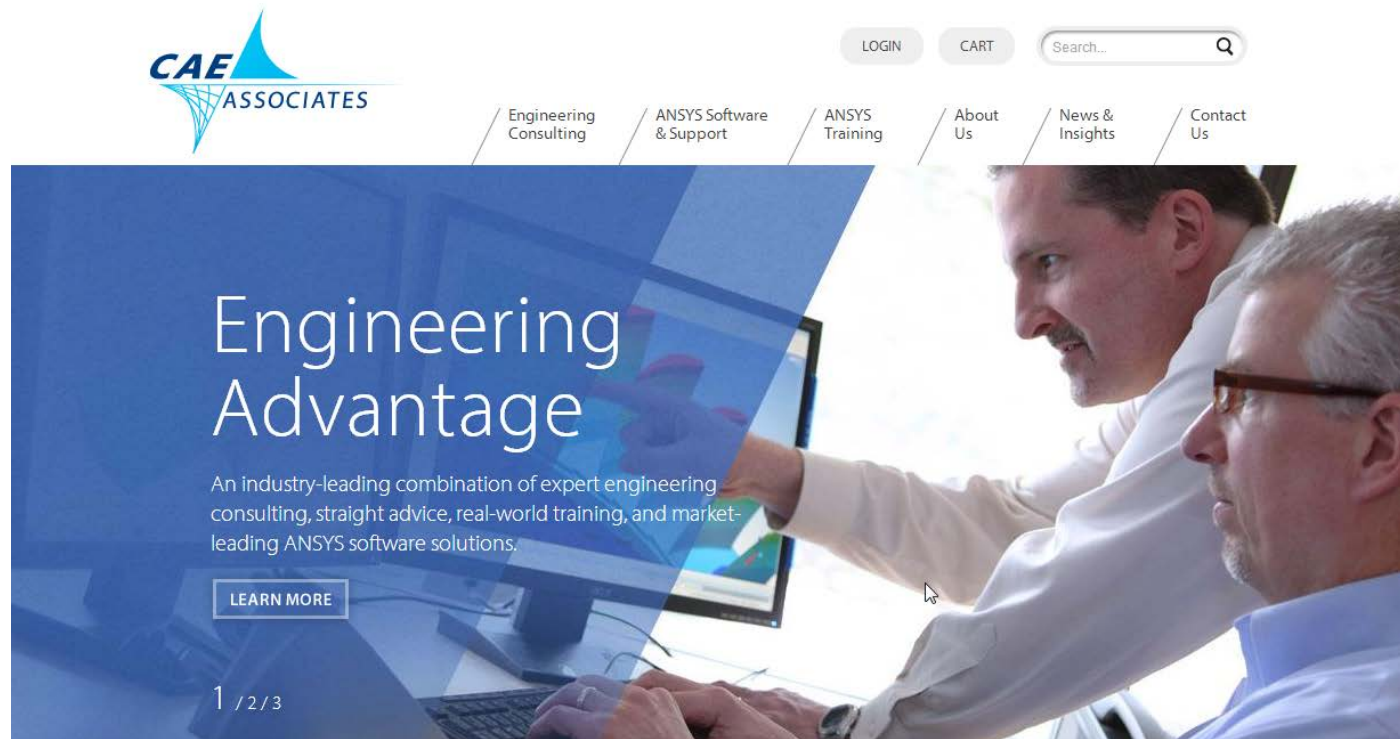


Advanced Meshing Techniques in ANSYS Workbench

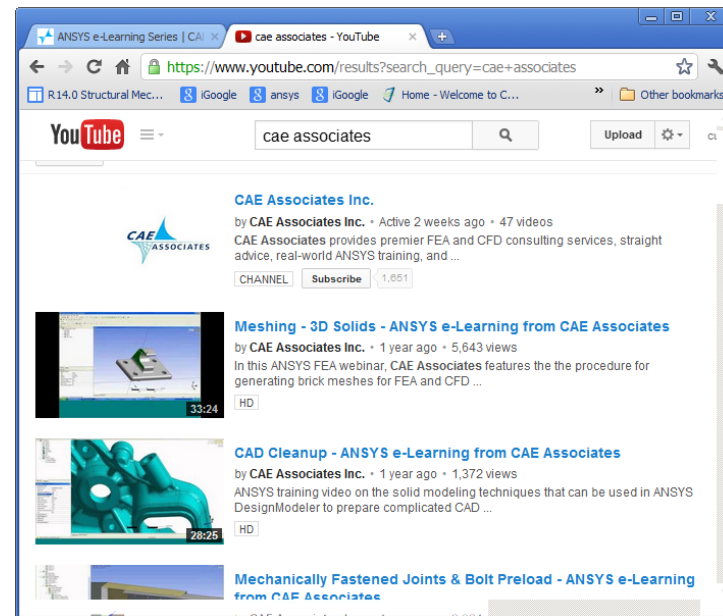
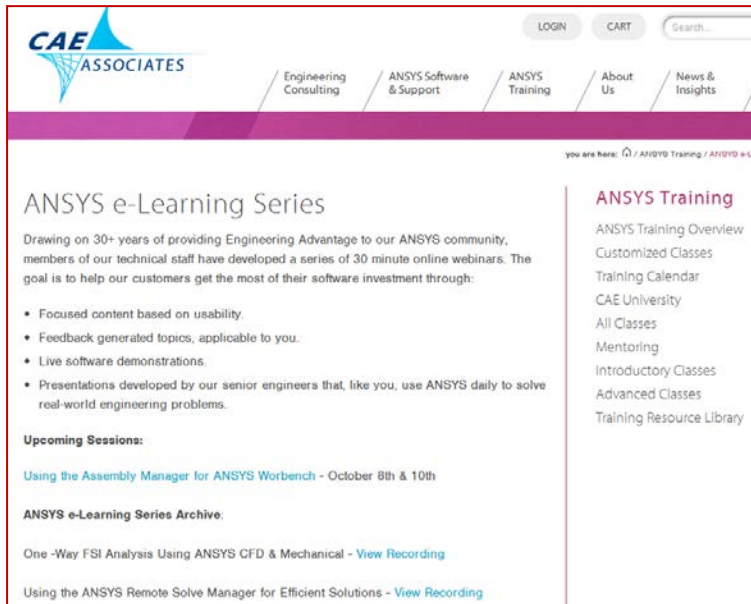
Presented by:
Eric Stamper
4/9/2015



- Engineering Consulting Firm in Middlebury, CT specializing in FEA and CFD analysis.
- ANSYS® Channel Partner since 1985 providing sales of the ANSYS® products, training and technical support.

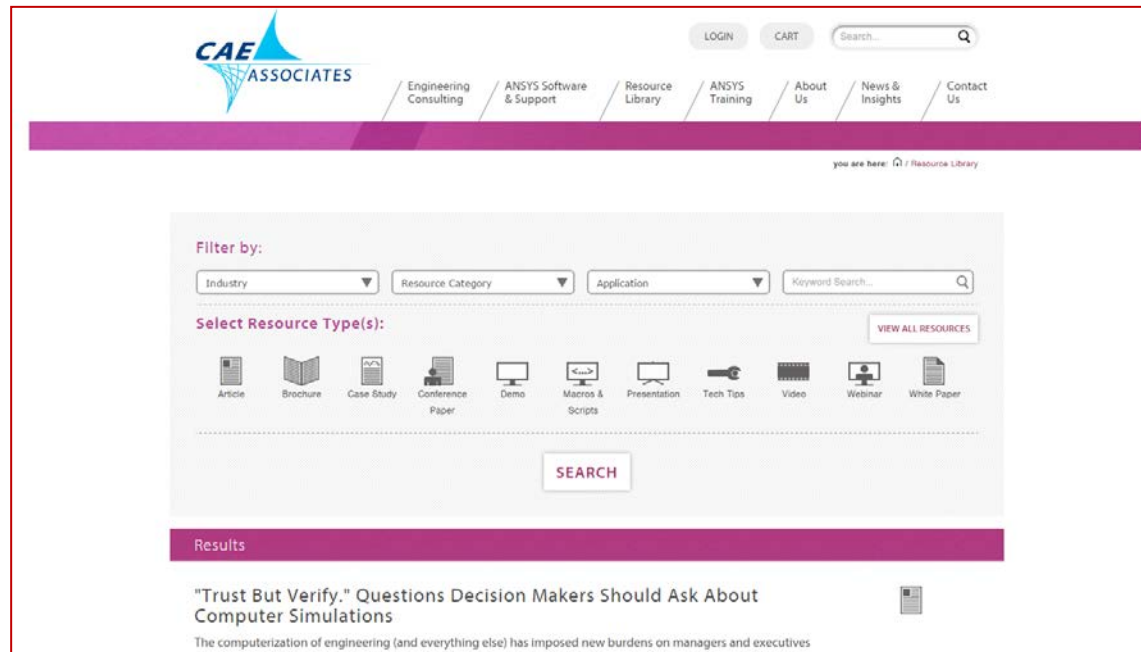


- This presentation is part of a series of e-Learning webinars offered by CAE Associates.
- You can view many of our previous e-Learning sessions either on our website or on the CAE Associates YouTube channel:

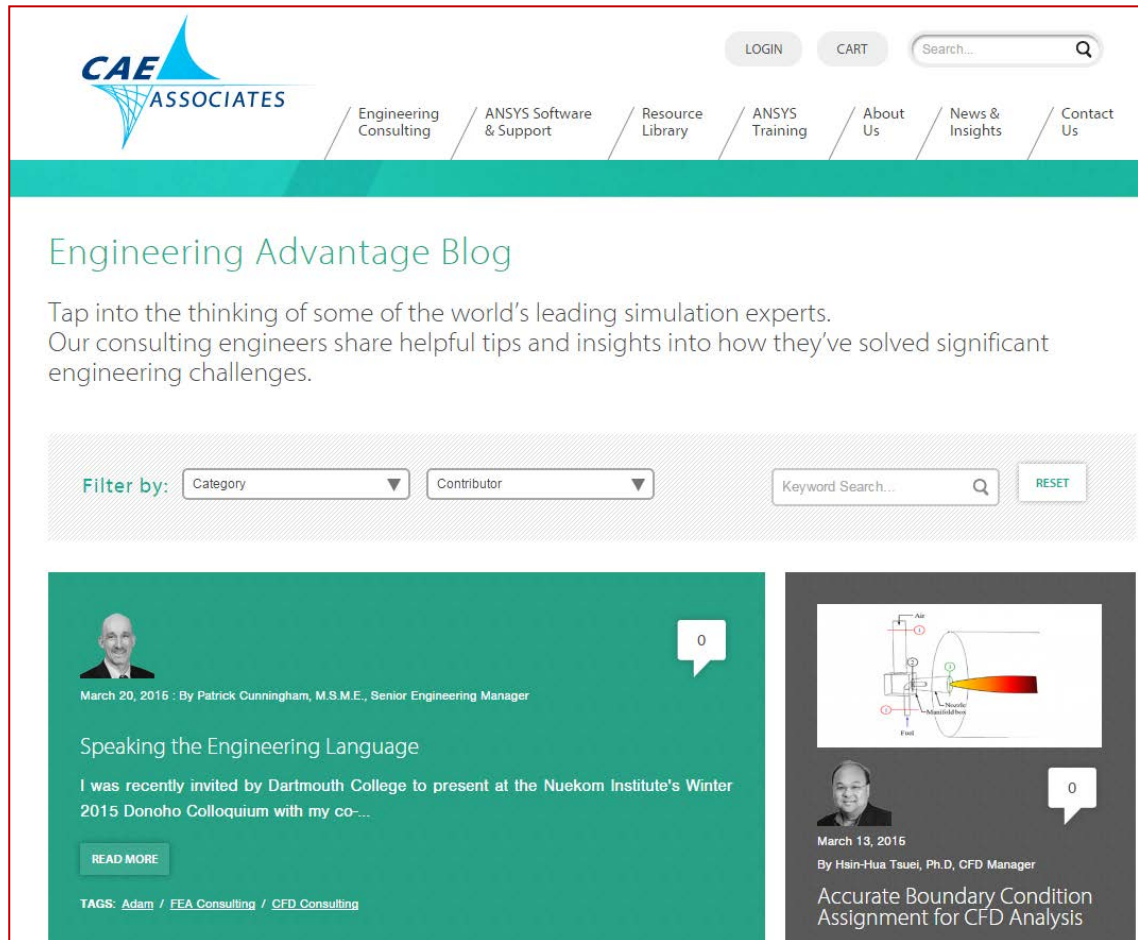


- If you are a New Jersey or New York resident you can earn continuing education credit for attending the full webinar and completing a survey which will be emailed to you after the presentation.

- Our Resource Library contains over 250 items including:
 - Consulting Case Studies
 - Conference and Seminar Presentations
 - Software demonstrations
 - Useful macros and scripts
- The content is searchable and you can download copies of the material to review at your convenience.

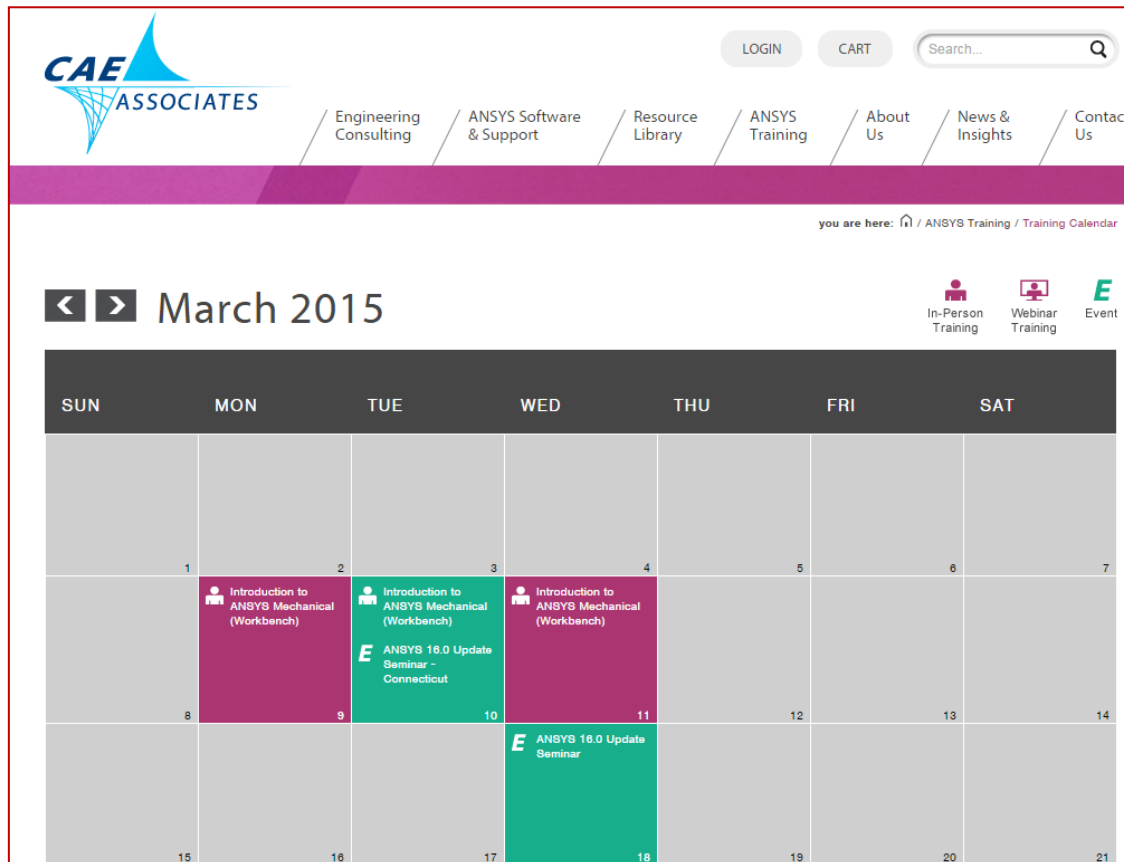


- Our Engineering Advantage Blog offers weekly insights from our experienced technical staff.



The screenshot shows the homepage of the CEA Engineering Advantage Blog. At the top is the CEA ASSOCIATES logo and a navigation menu with links: Engineering Consulting, ANSYS Software & Support, Resource Library, ANSYS Training, About Us, News & Insights, and Contact Us. There are also buttons for LOGIN and CART, and a search bar. Below the navigation is a teal banner with the title "Engineering Advantage Blog" and a sub-header: "Tap into the thinking of some of the world's leading simulation experts. Our consulting engineers share helpful tips and insights into how they've solved significant engineering challenges." Below this is a filter section with "Filter by:" followed by dropdown menus for "Category" and "Contributor", a "Keyword Search..." input field, and a "RESET" button. The main content area features two blog posts. The first post, dated March 20, 2016, by Patrick Cunningham, M.S.M.E., Senior Engineering Manager, is titled "Speaking the Engineering Language" and includes a "READ MORE" button and tags for Adam, FEA Consulting, and CFD Consulting. The second post, dated March 13, 2016, by Hsin-Hua Tsuei, Ph.D., CFD Manager, is titled "Accurate Boundary Condition Assignment for CFD Analysis" and features a diagram of a fluid flow simulation.

- Classes can be held at our Training Center at CAE Associates or on-site at your location.
- CAE Associates is offering on-line training classes in 2015!
- Registration is available on our website.



The screenshot shows the CAE Associates website with a navigation bar containing links for Engineering Consulting, ANSYS Software & Support, Resource Library, ANSYS Training, About Us, News & Insights, and Contact Us. A search bar and LOGIN/CART buttons are also present. Below the navigation bar, a breadcrumb trail indicates the current location: you are here: / ANSYS Training / Training Calendar.

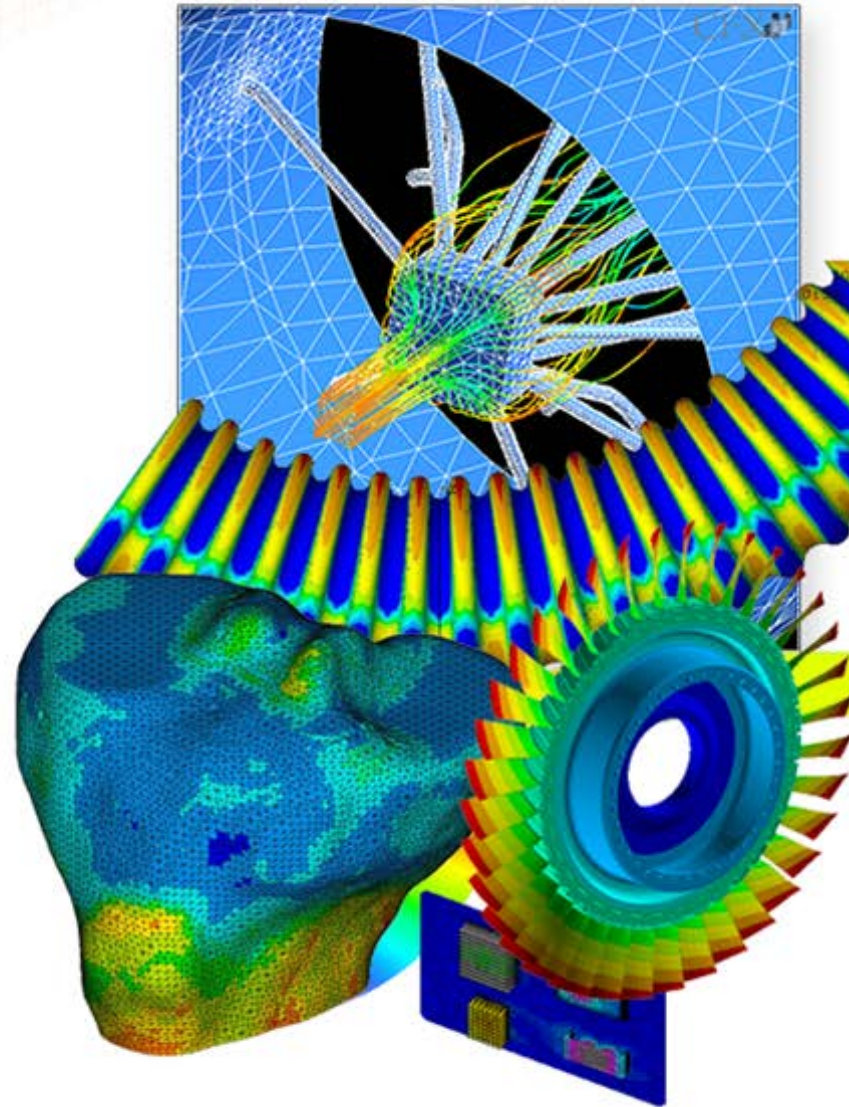
The main content area displays a calendar for March 2015. The calendar is a grid with days of the week (SUN to SAT) as columns and dates (1 to 21) as rows. Training events are listed in specific cells:

- March 9 (Monday):** Introduction to ANSYS Mechanical (Workbench) (In-Person Training icon)
- March 10 (Tuesday):** Introduction to ANSYS Mechanical (Workbench) (In-Person Training icon) and ANSYS 16.0 Update Seminar - Connecticut (Event icon)
- March 11 (Wednesday):** Introduction to ANSYS Mechanical (Workbench) (In-Person Training icon)
- March 18 (Wednesday):** ANSYS 16.0 Update Seminar (Event icon)

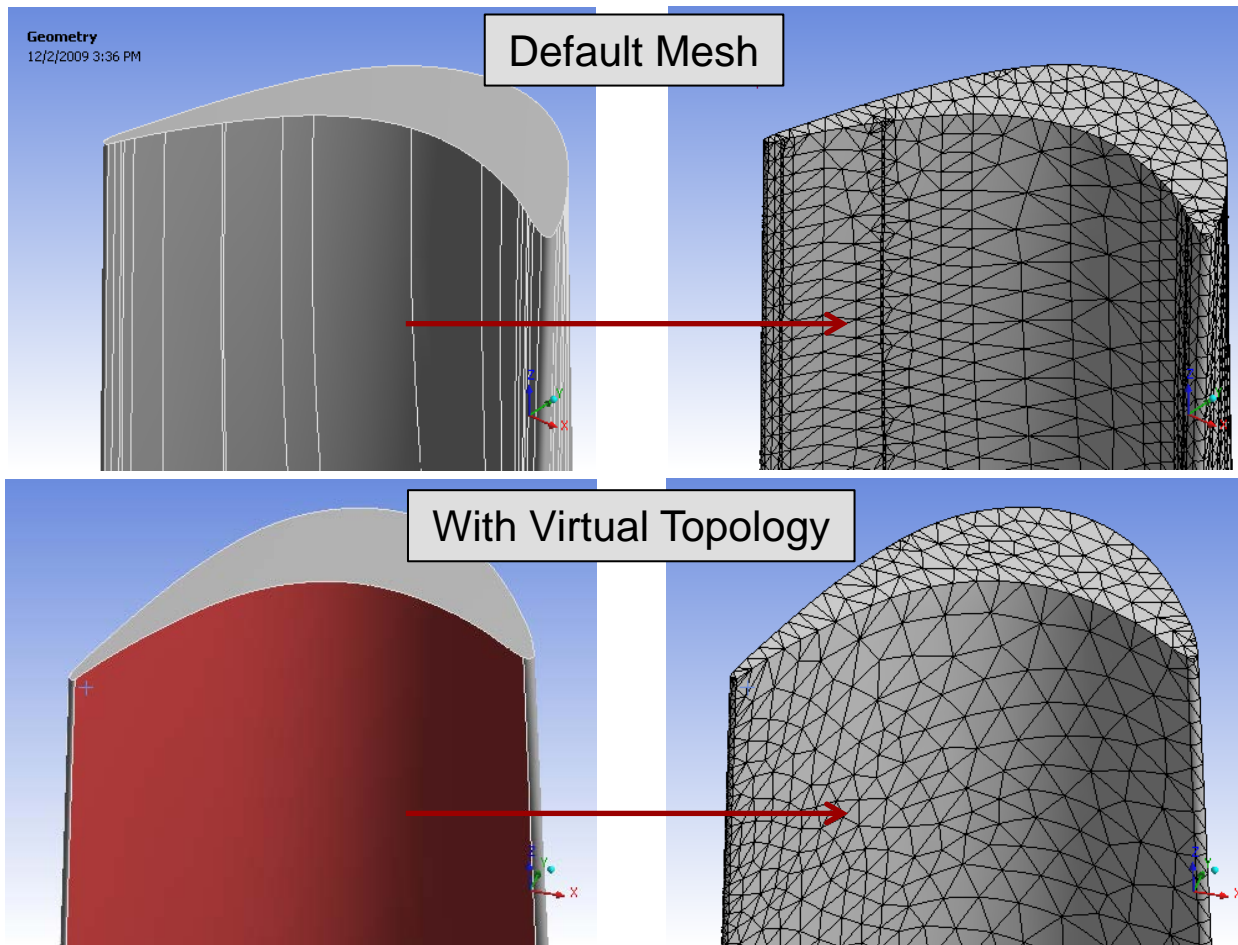
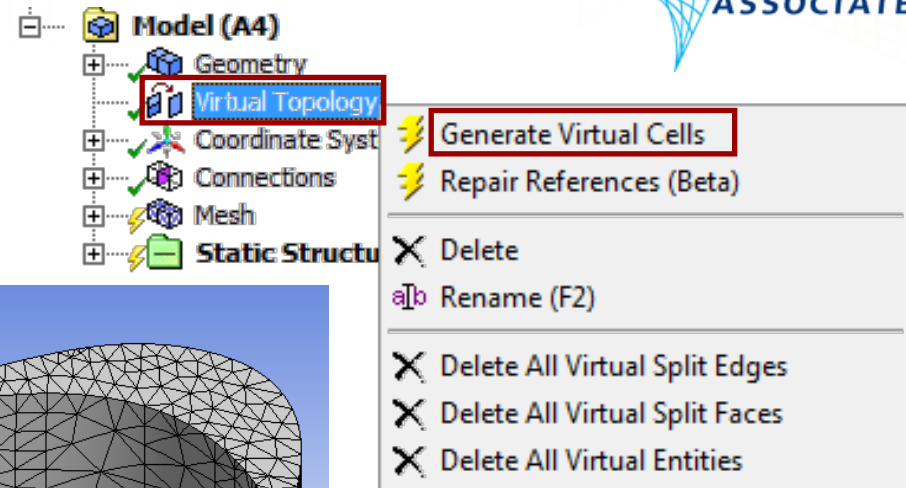
Legend: In-Person Training (person icon), Webinar Training (webinar icon), Event (E icon).

- Advanced Workbench Meshing Overview
 - Mesh Based Defeaturing
 - Hexahedral Meshing
 - Refinement within volumes
- CAE Associates has a 2-Day advanced ANSYS Workbench meshing class offered in our Middlebury, CT office.
- We're also offering a 4 hour online course that covers specialized meshing topics.
 - Sign up if you're interested!

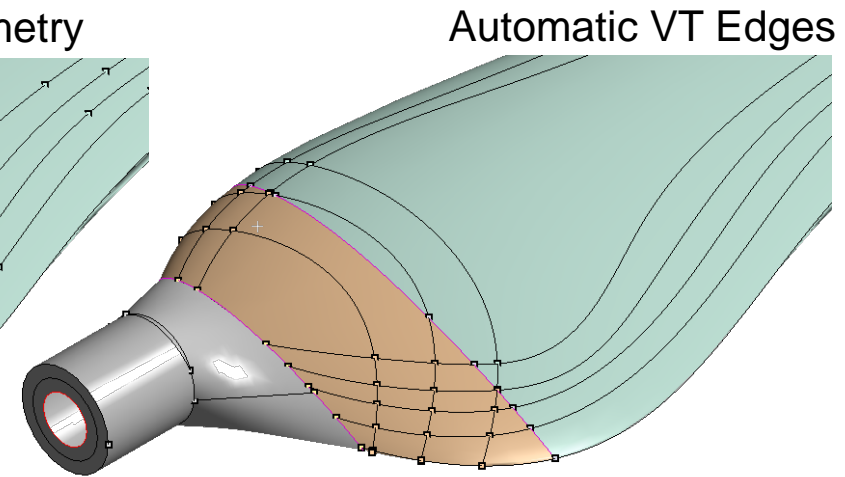
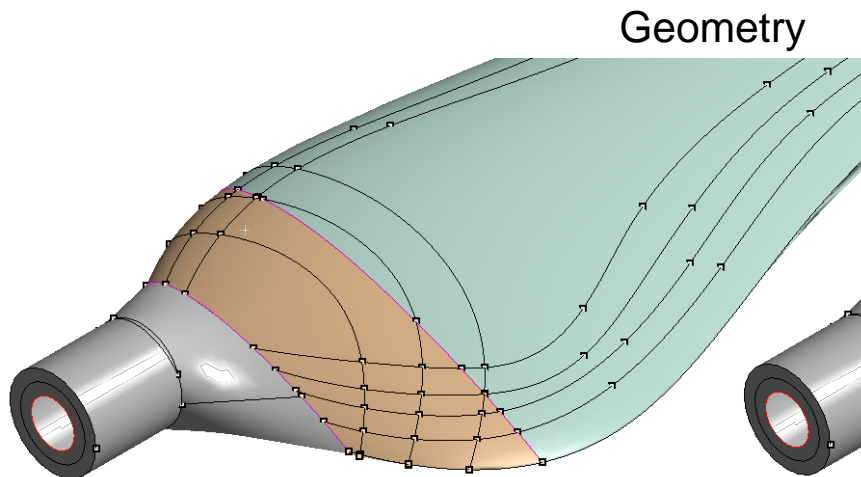
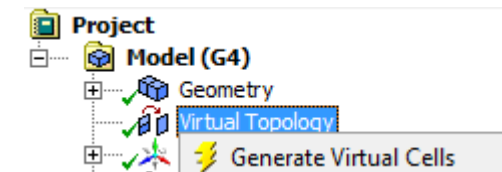
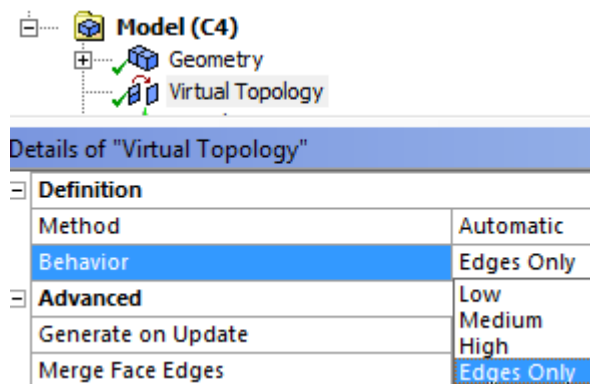
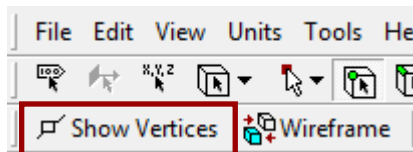
Defeaturing



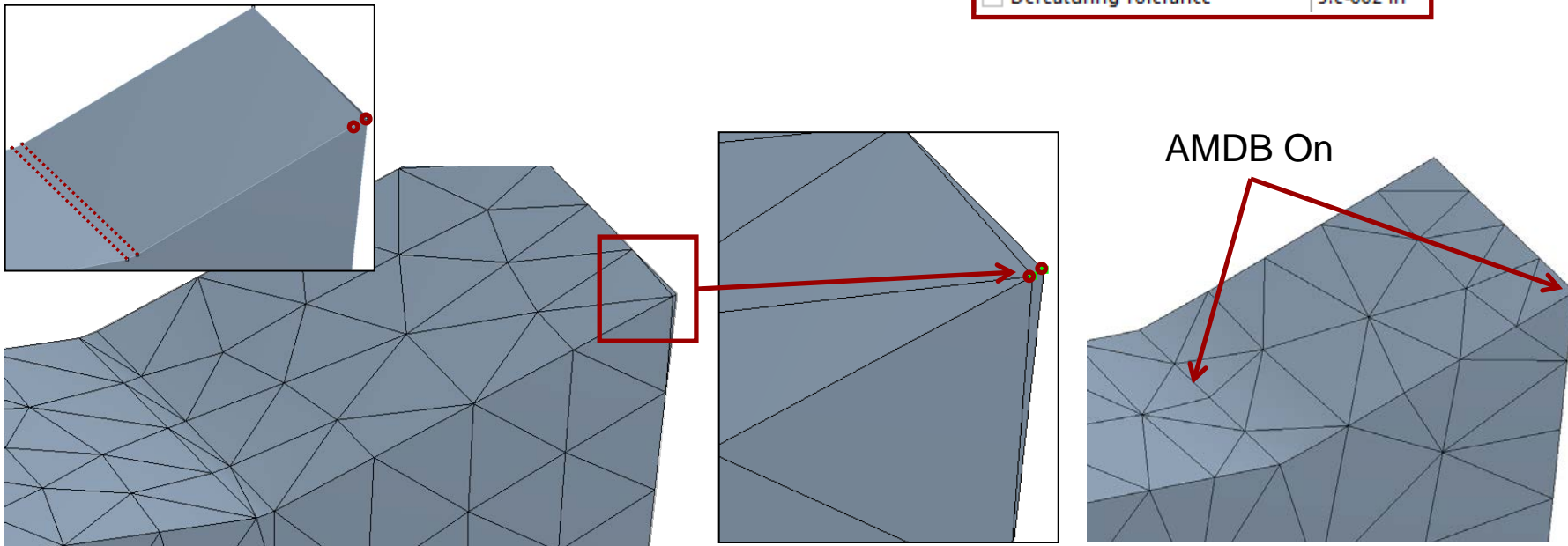
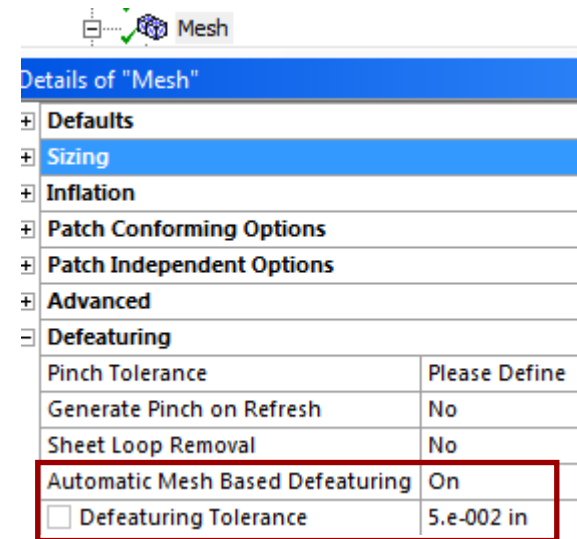
- Cleaning up messy geometry:
 - Virtual cells eliminate the need to mesh sliver surfaces.



- Automatic Edge Concatenation:
 - “Show Vertices”
 - Set “Edges Only” in details menu of Virtual Topology
 - RMB Click > Generate Virtual Cells



- Useful to:
 - Improve the mesh quality
 - Allow for a successful mesh to be created when these very small features would otherwise cause a meshing failure
- Removes small geometric features that are smaller than the Automatic Mesh Based Defeaturing (AMBD) tolerance



- Tetrahedron Surface Mesh Comparison:

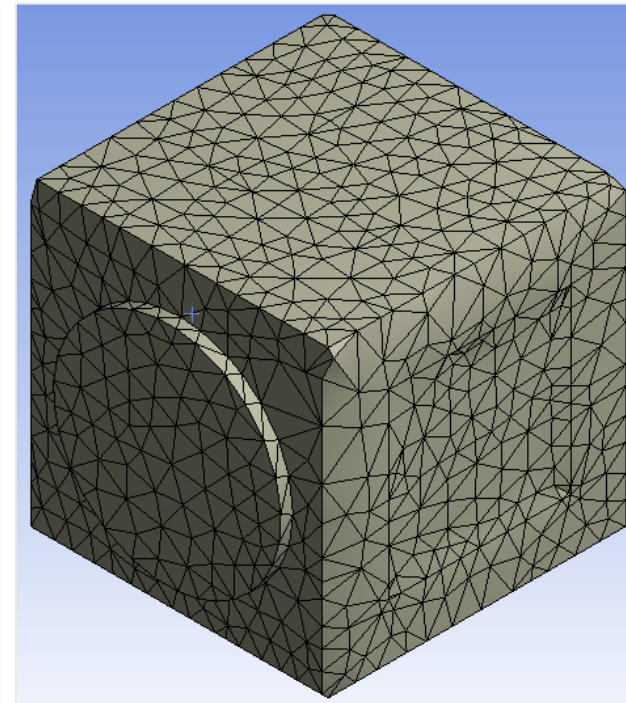
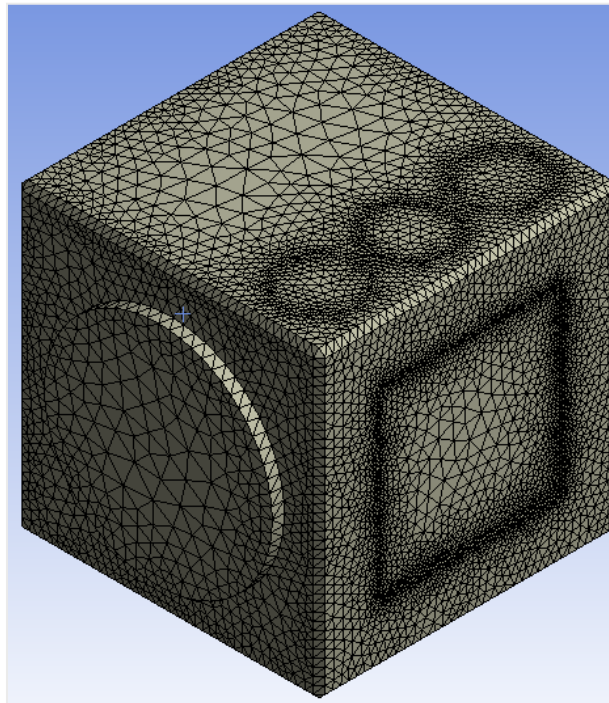
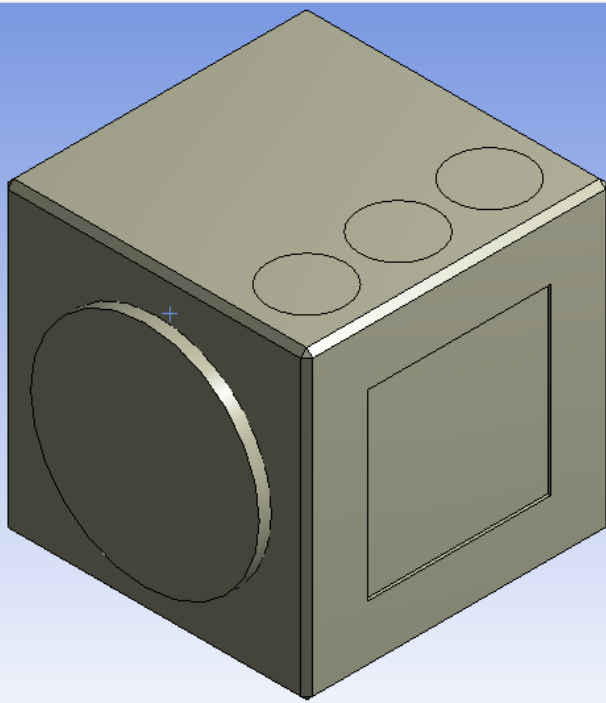
Geometry containing
small details

Patch Conforming

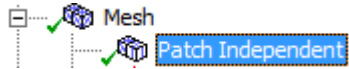
All geometric detail is
captured

Patch Independent

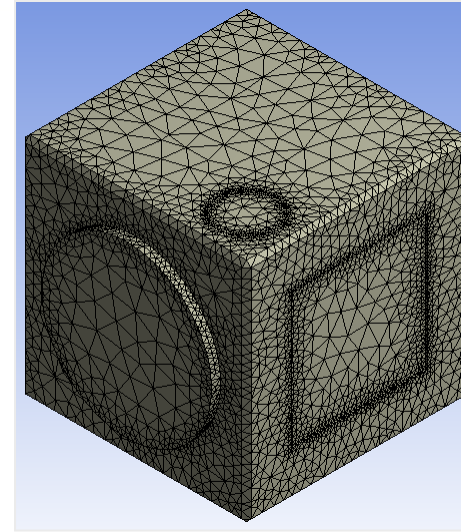
Can ignore and
defeature geometry



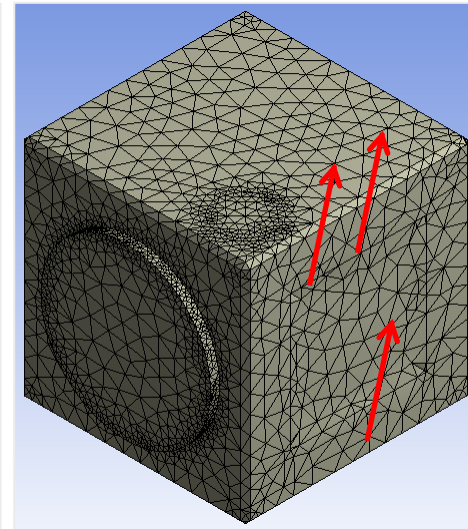
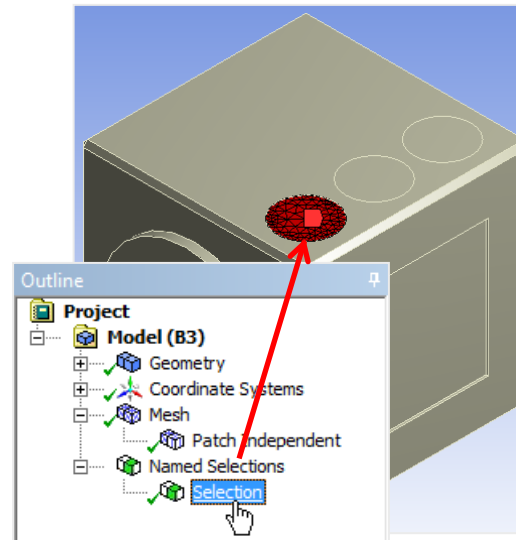
- Patch Independent
 - Defeaturing Control
 1. Set Mesh Based Defeaturing On
 2. Set Defeaturing Tolerance
 3. Assign Named Selections to selectively preserve geometry



Advanced	
Defined By	Max Element Size
<input type="checkbox"/> Max Element Size	Default(0.175 m)
<input type="checkbox"/> Feature Angle	30.0 °
<input checked="" type="checkbox"/> Mesh Based Defeaturing	On
<input type="checkbox"/> Defeaturing Tolerance	3.e-002 m
Curvature and Proximity Refinement	Yes



Defeaturing
Tolerance Off



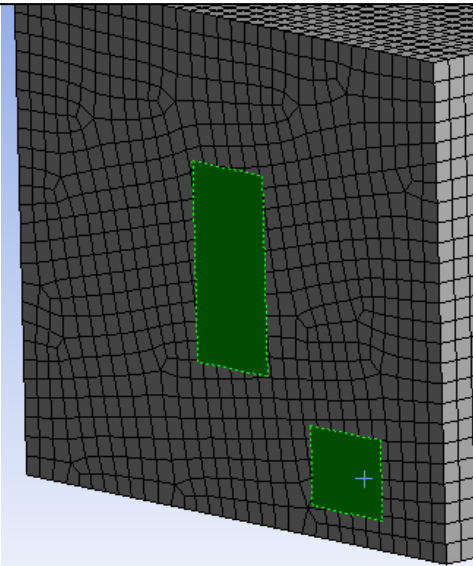
Named Selection assigned and
Defeaturing Tolerance = 0.03m.
Features > 0.03m respected.

- MultiZone:
 - Default only captures sharp features, named selections, boundary conditions, etc. (patch independent)
 - All topology can be captured with Preserve Boundaries set to All, (patch conforming)

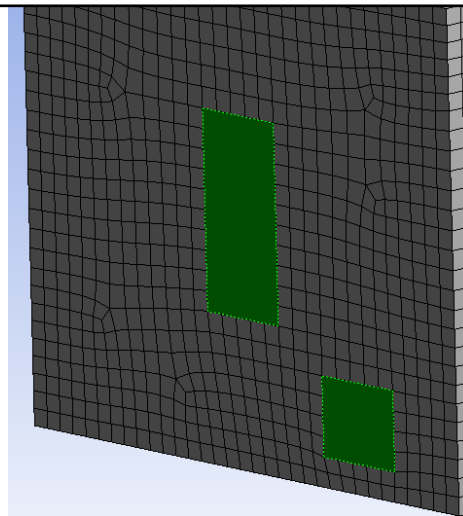
Details of "MultiZone" - Method	
+ Scope	
+ Definition	
- Advanced	
Preserve Boundaries	Protected
Mesh Based Defeating	Protected
Minimum Edge Length	0.1 in
Write ICEM CFD Files	No

Preserve Boundaries = Protected (Default)

Ignores imprint features

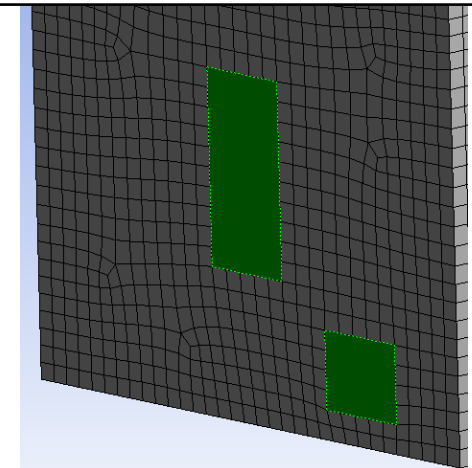


If named selections are defined Topology is respected

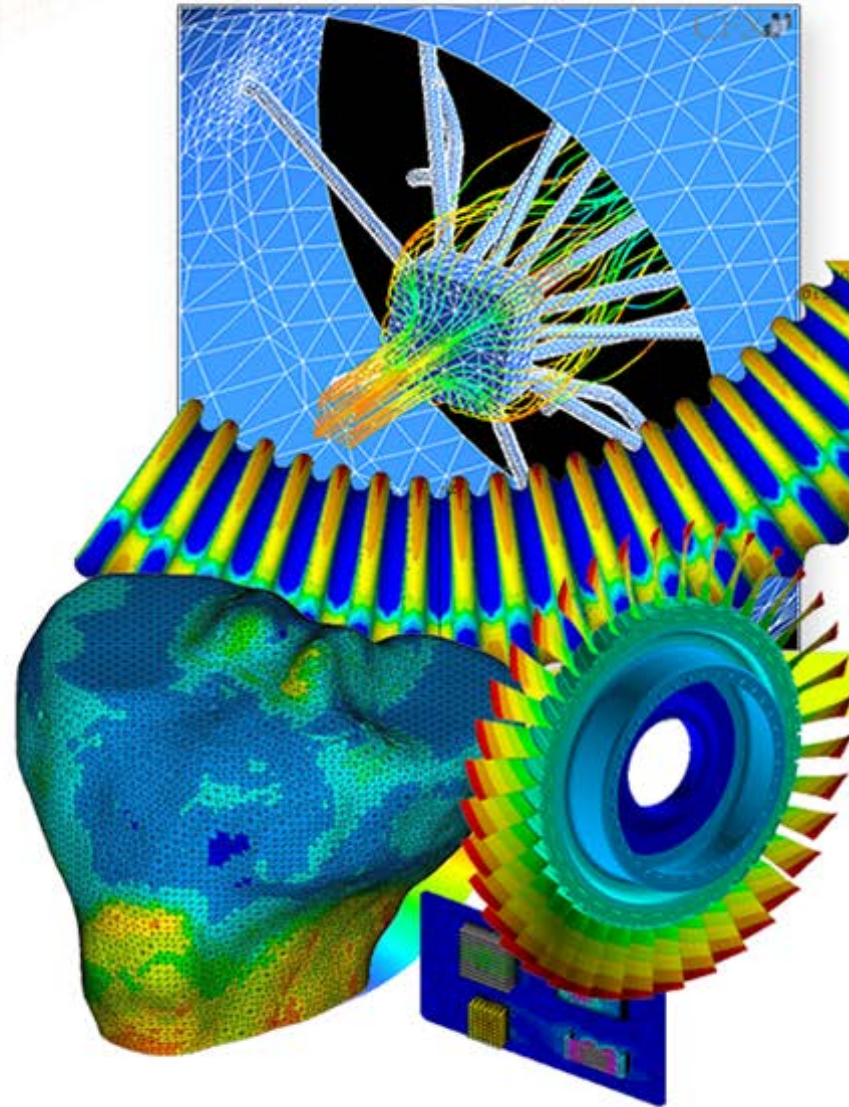


Preserve Boundaries = All

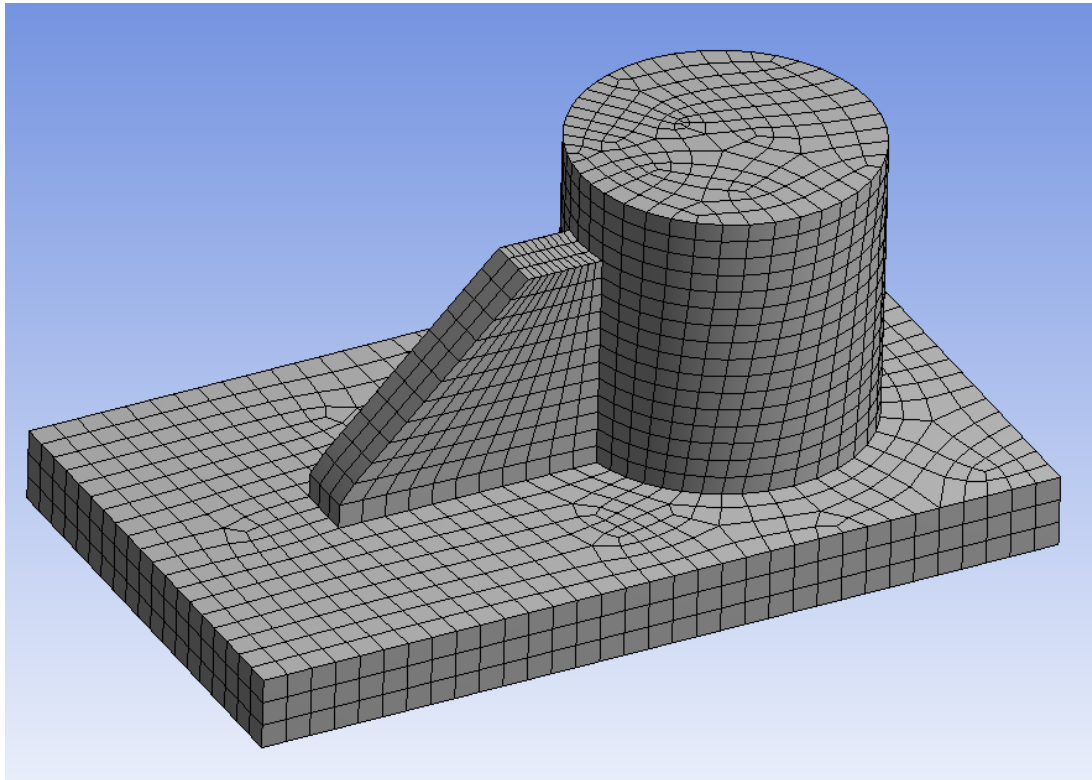
Mesh captures all topology, regardless of whether it is in a named selection, BC, etc.




Hexahedral Meshing

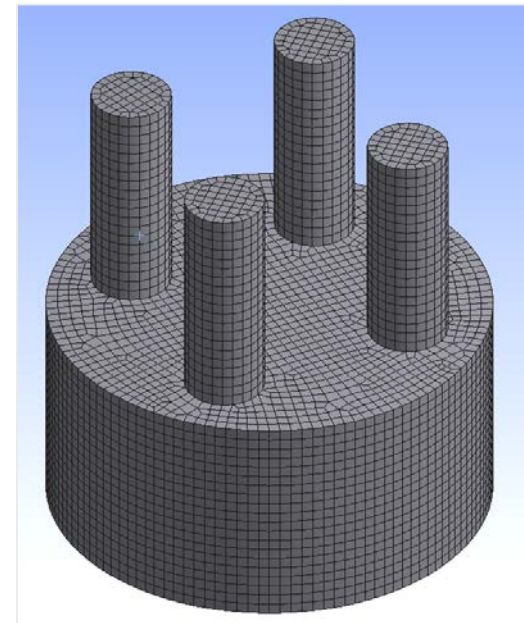


- Method Behavior
 - Automatically decomposes geometry into blocks
 - Used to extend sweeping capabilities to a larger range of problems

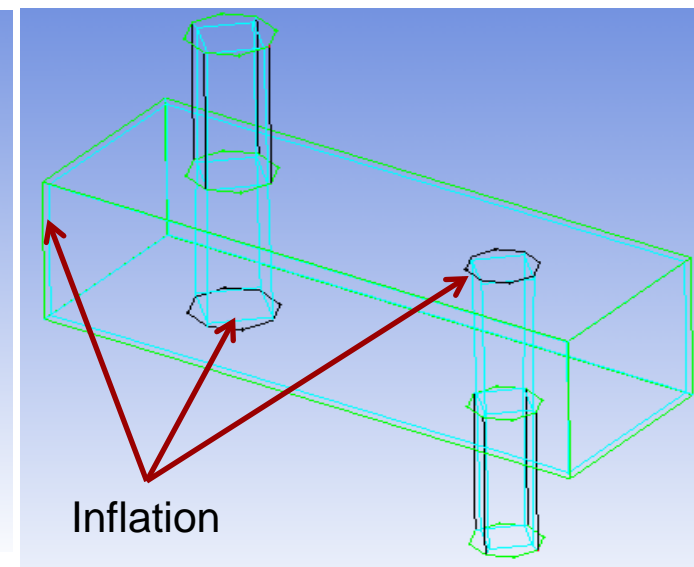
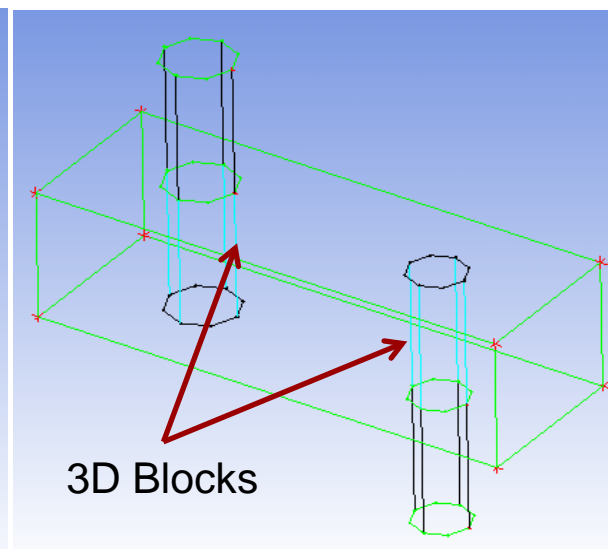
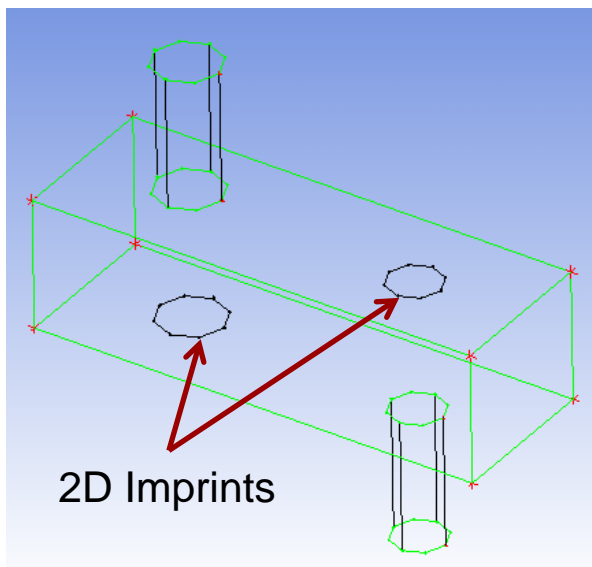
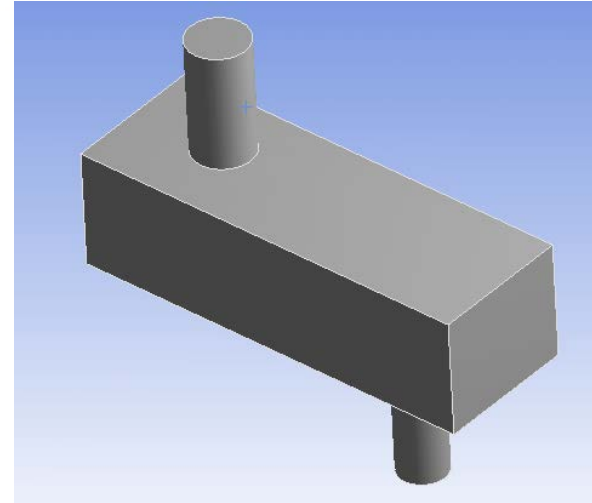


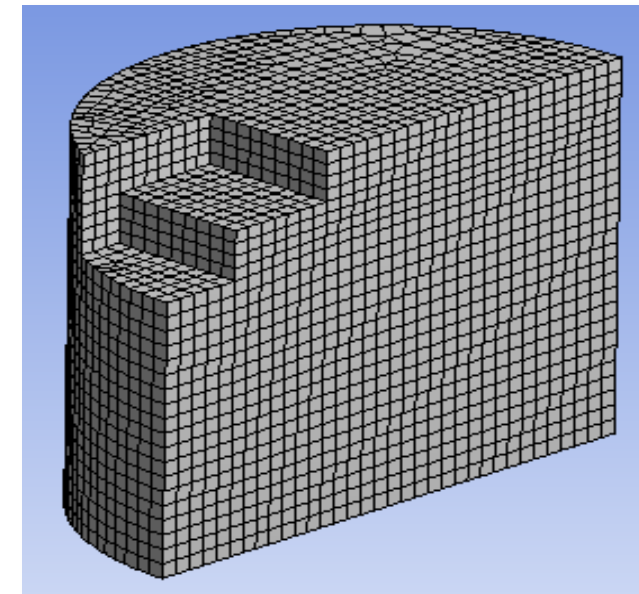
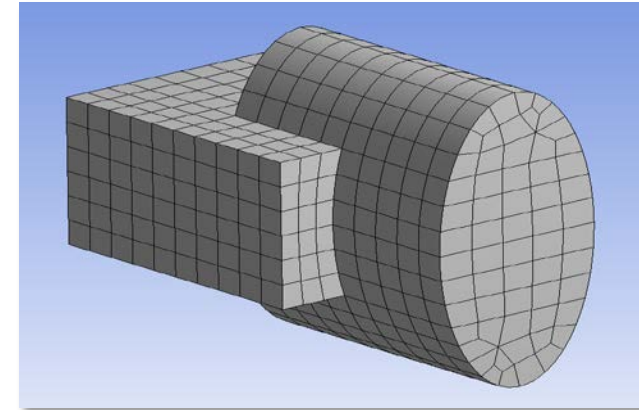
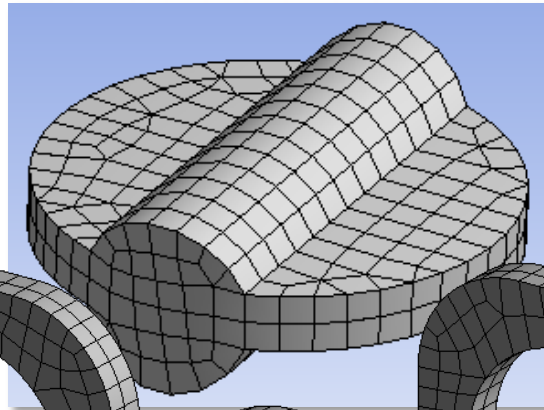
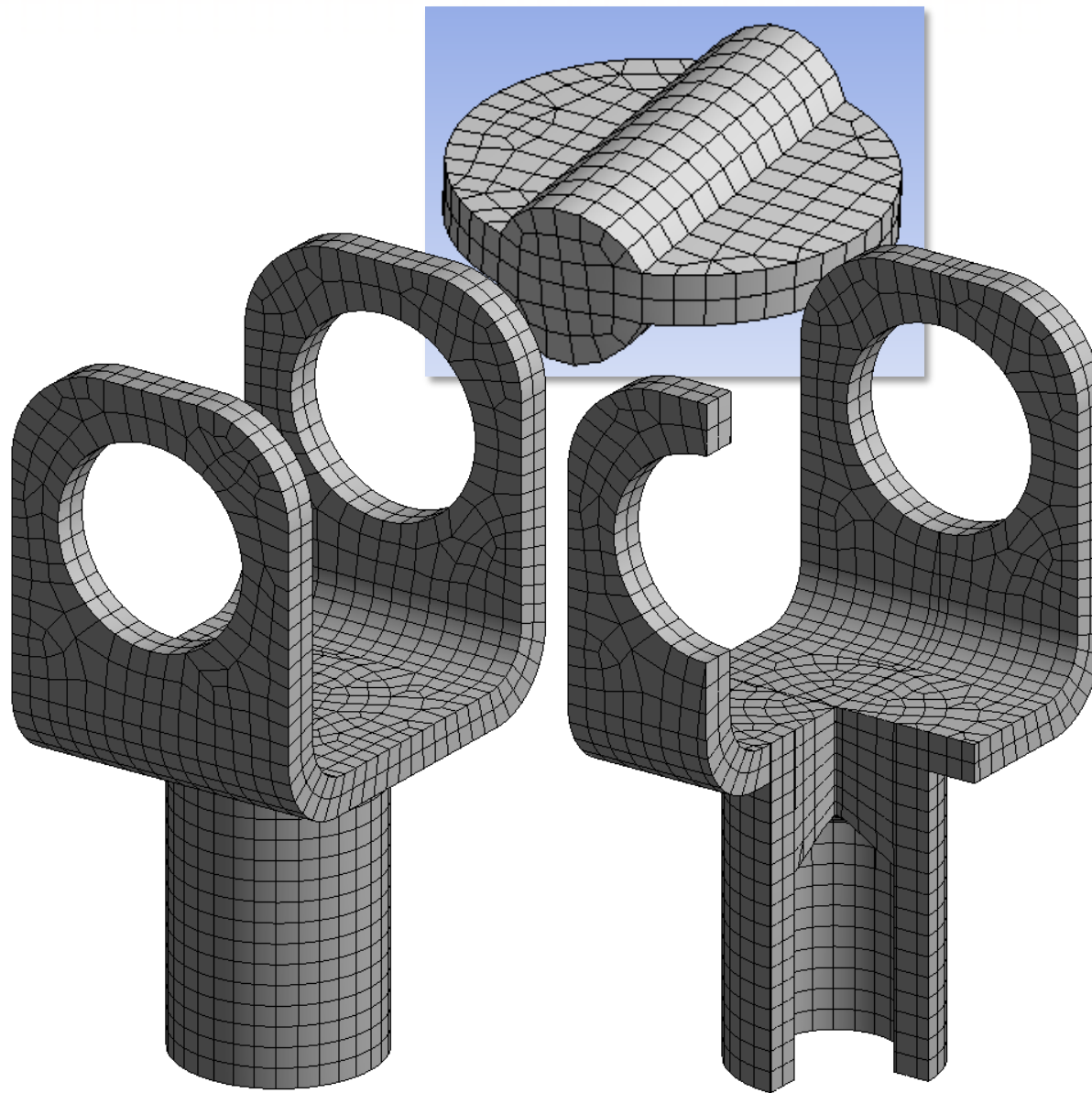
Details of "MultiZone" - Method 

[-] Scope	
Scoping Method	Geometry Selection
Geometry	1 Body
[-] Definition	
Suppressed	No
Method	MultiZone
Mapped Mesh Type	Hexa
Surface Mesh Method	Program Controlled
Free Mesh Type	Not Allowed
Element Midside Nodes	Use Global Setting
Src/Trg Selection	Manual Source
Source	4 Faces
[+] Advanced	

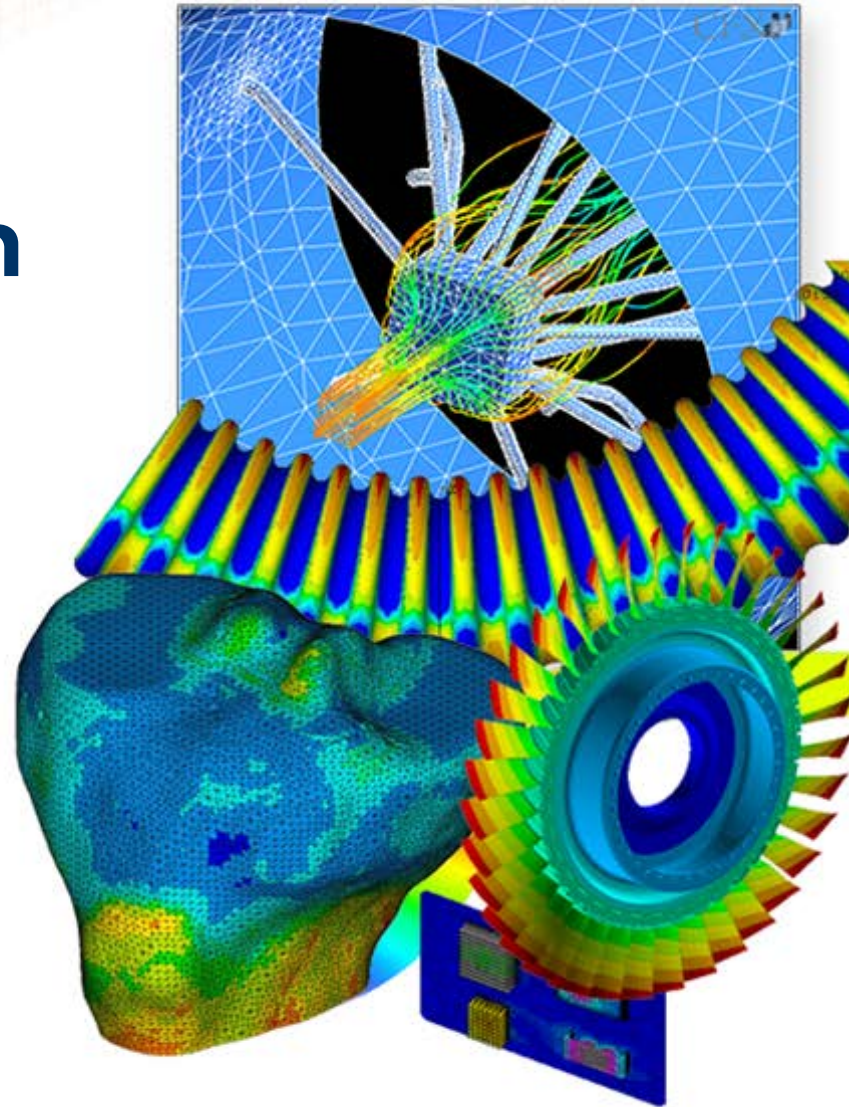


- Algorithm:
 - Step 1) 2D Blocking
 - Step 2) 3D Blocking
 - Step 3) Inflation (if applied)

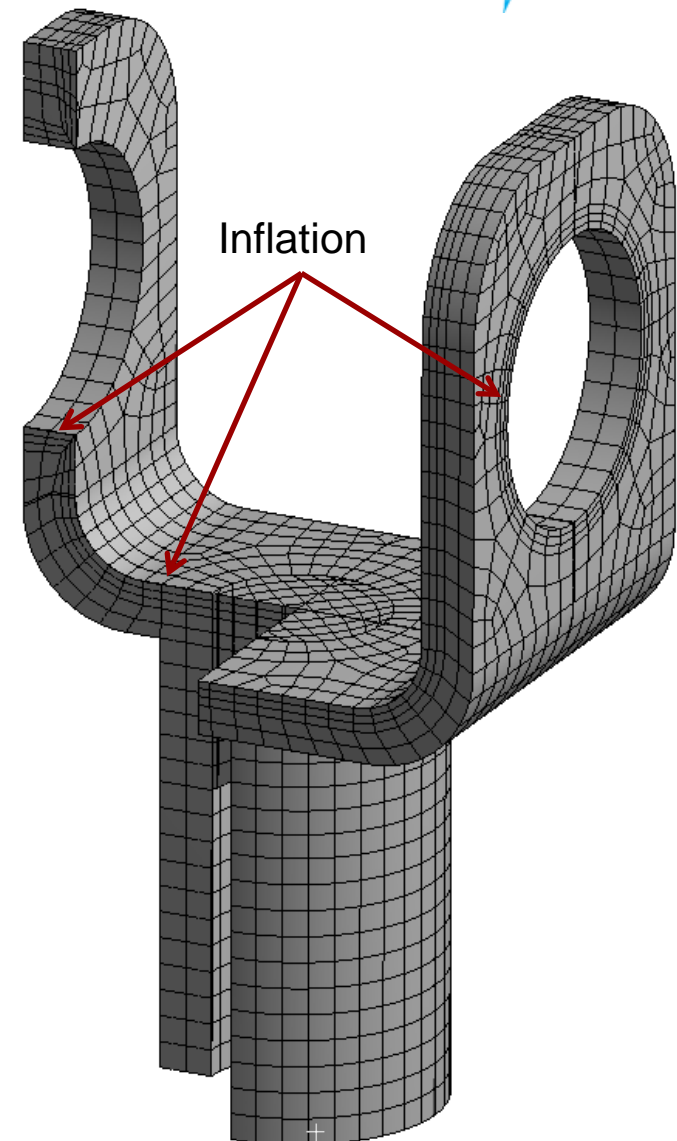
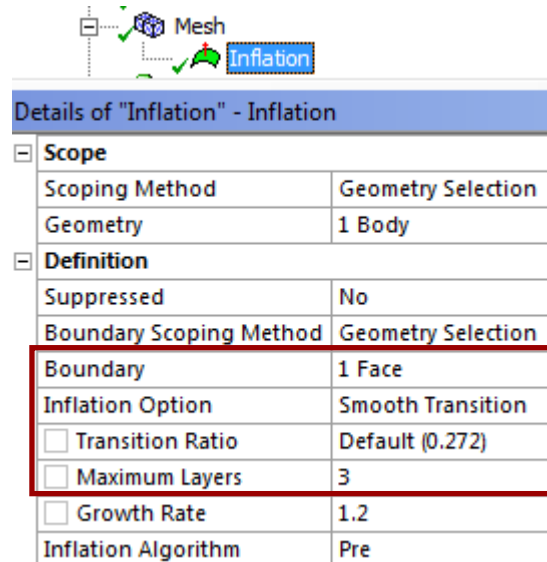




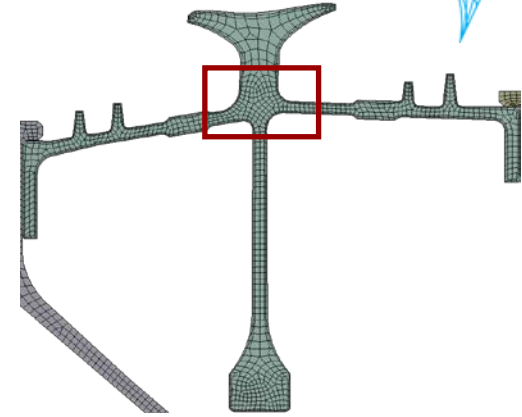
Refinement within Volumes



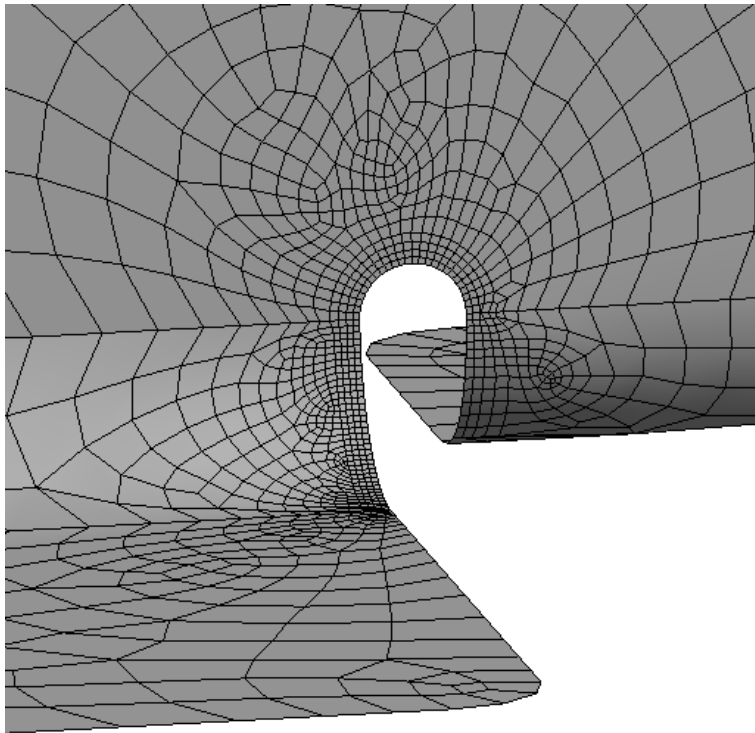
- Inflation
 - Used to generate thin elements adjacent to boundaries / surfaces
 - Useful to capture high subsurface result gradients:
- Elements shown are created by 'inflating' the 3D surface mesh into the volume
- Inflation works with both bricks and tets



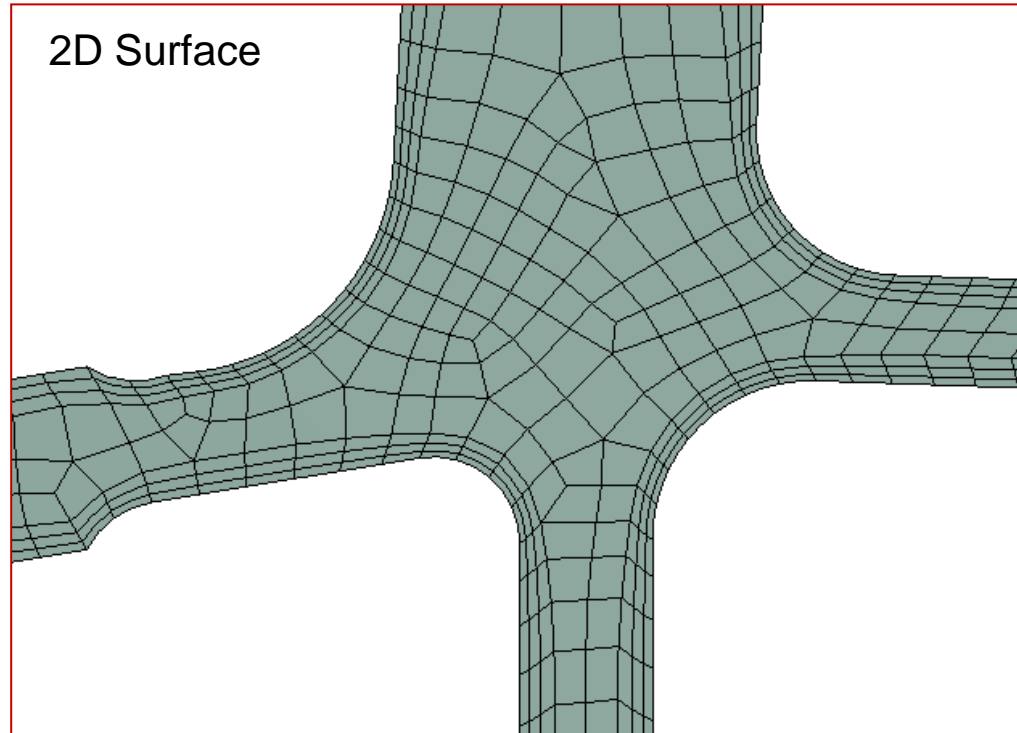
- Inflation also works with surfaces
- Elements shown are created by “inflating”
 - 2D or 3D boundary edge onto the face



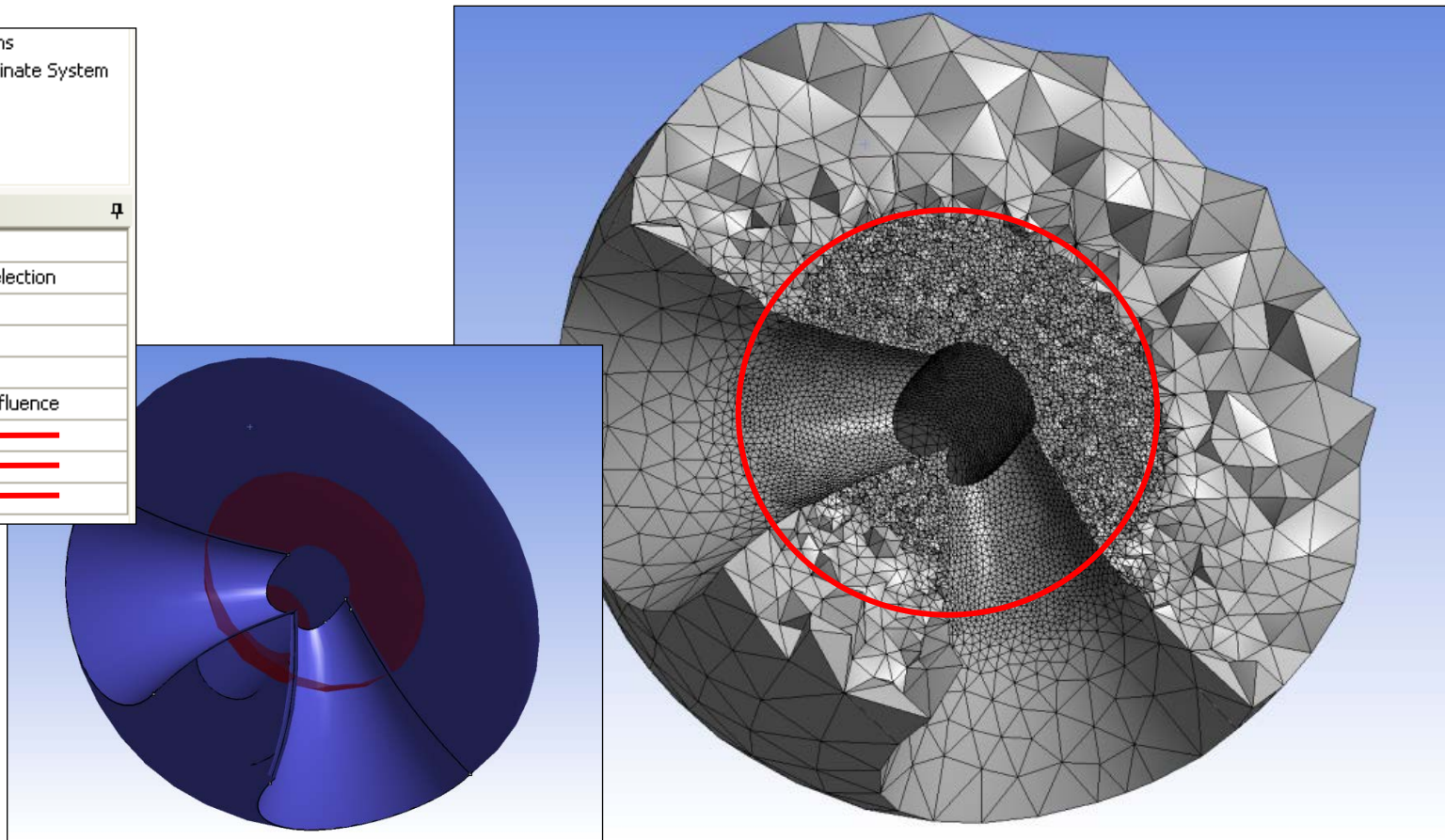
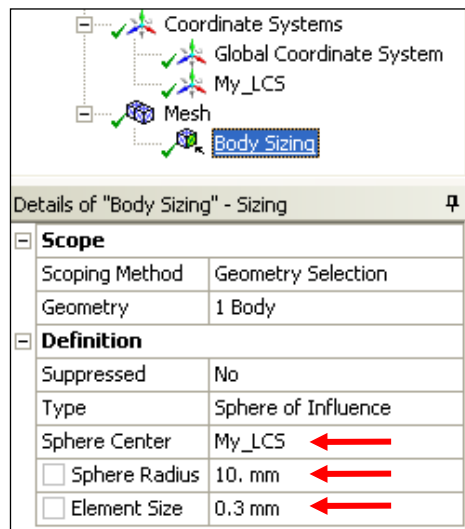
3D Shell



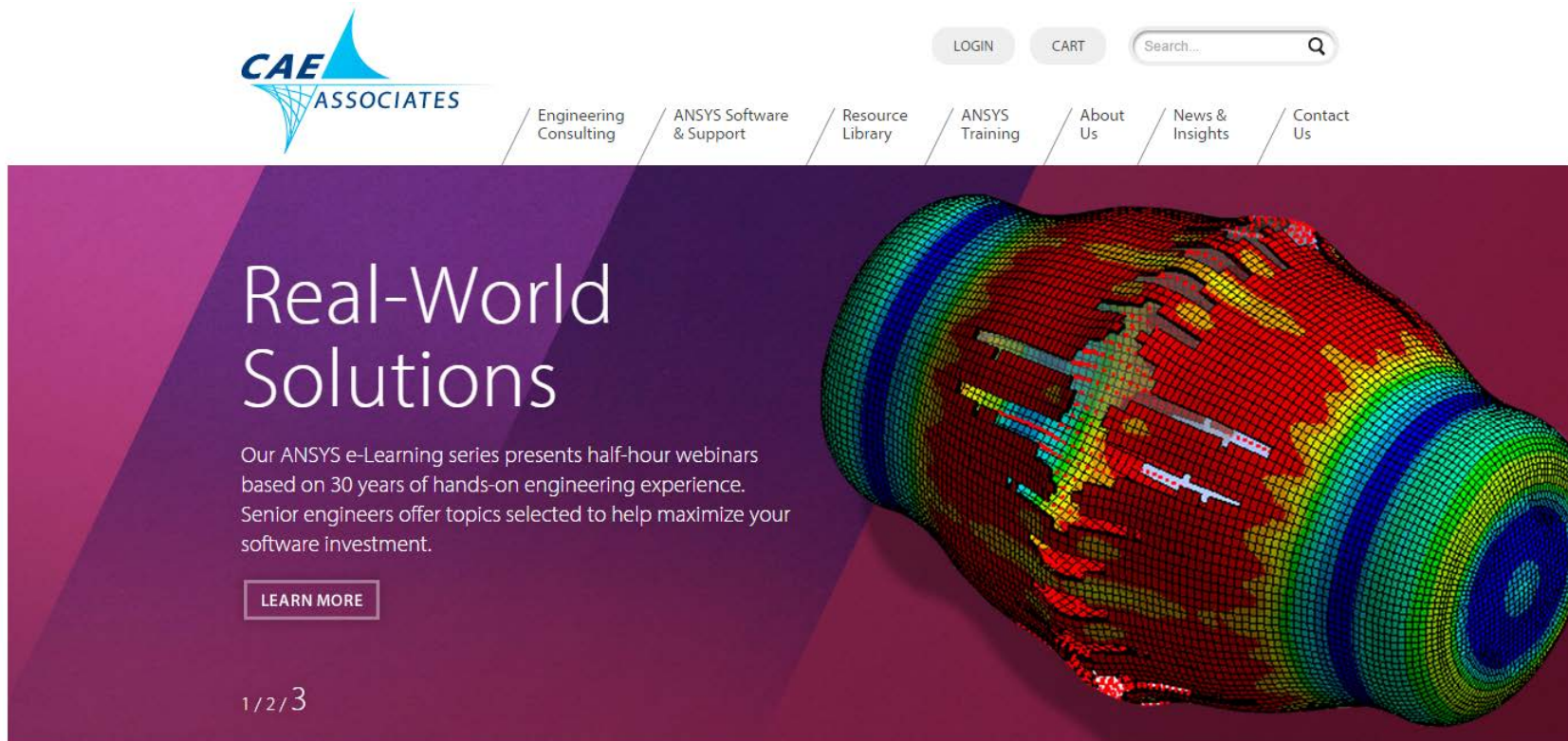
2D Surface



- Sphere of Influence: on Bodies
 - Constant element size is applied within the confines of a sphere
 - Use coordinate system to define the center of the Sphere



- Please visit us online at caeai.com



The screenshot shows the CAE Associates website homepage. At the top is the CAE Associates logo. To the right are links for LOGIN, CART, and a search bar. Below these are navigation links: Engineering Consulting, ANSYS Software & Support, Resource Library, ANSYS Training, About Us, News & Insights, and Contact Us. The main banner features the text "Real-World Solutions" and a description of the ANSYS e-Learning series. A "LEARN MORE" button is present. On the right is a large image of a 3D mesh model of a mechanical part with a color-coded stress distribution. At the bottom left of the banner is a "1/2/3" indicator.

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