

Module 3: Repairing Geometry



Fluid Dynamics

Structural Mechanics

Electromagnetics

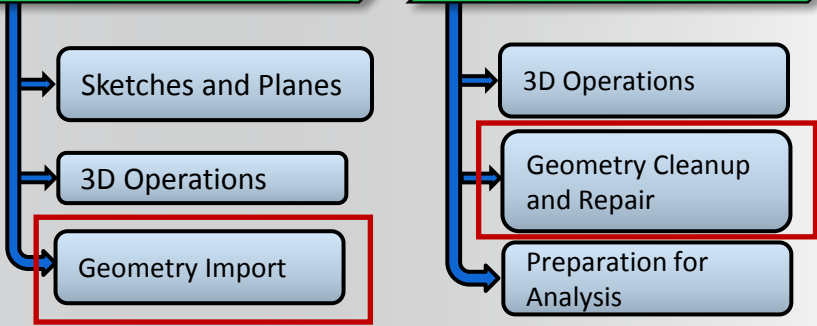
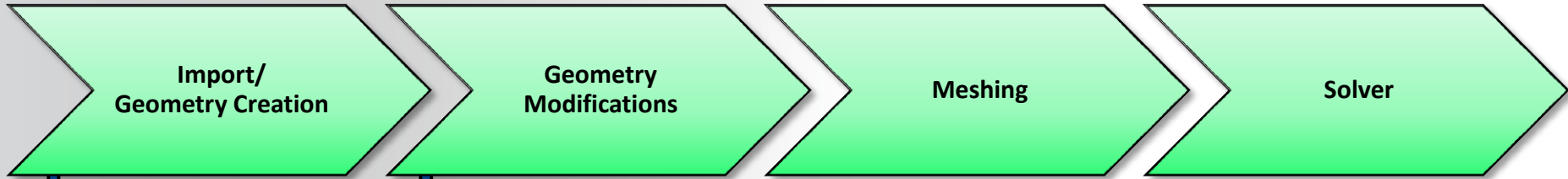
Systems and Multiphysics

Introduction to ANSYS SpaceClaim Direct Modeler

In this module we will learn about:

- **Importing Geometry in SpaceClaim Direct Modeler (SCDM)**
- **Need for repair**
- **Common issues found in geometry**
- **Fix Issues One-by-One Vs All-at-Once**
- **Specialized tools for repair**

Preprocessing Workflow



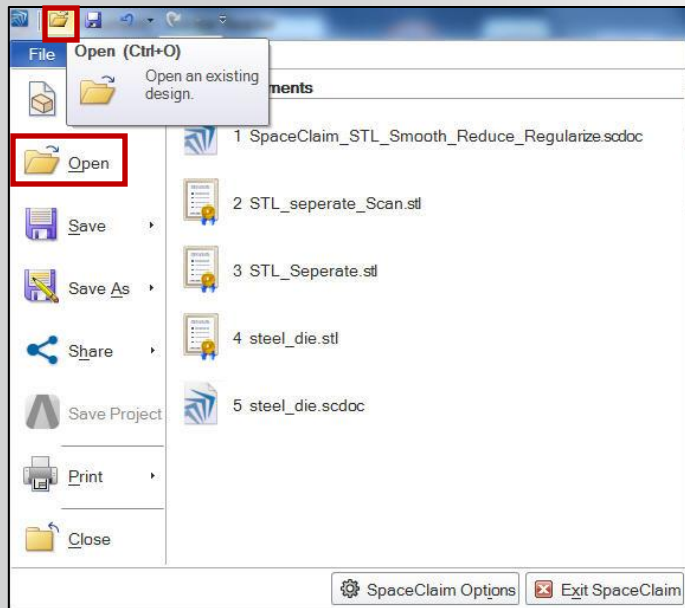
ANSYS SpaceClaim Direct Modeler

A	
1	Fluid Flow (Fluent)
2	Geometry ✓
3	Mesh ✓
4	Setup ↻
5	Solution ?
6	Results ?

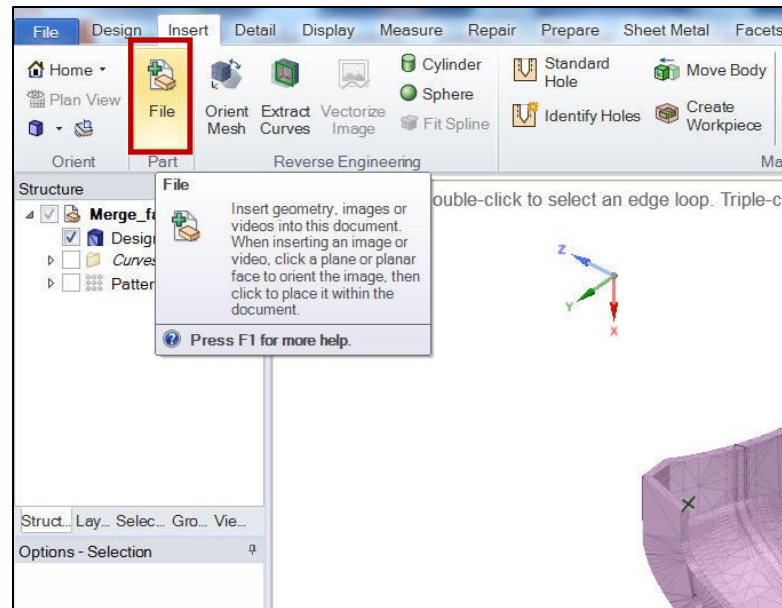
Fluid Flow (Fluent)

Two Import Options

Open CAD file in new session



Insert CAD file to existing session



File Formats

Supported Files

- Supports import from major CAD packages (CATIA, Pro/E, NX, Solid Works, etc.)
 - Separate license not required
- Neutral file formats like STEP and Parasolid are also supported
- Additional license are required for
 - Faceted Data Toolkit
 - JT Exchange
 - 3D PDF
- **Bi-directional Attach mode with other CAD software is not supported**
 - Needs a manual export from Spaceclaim into a format readable in the desired CAD software

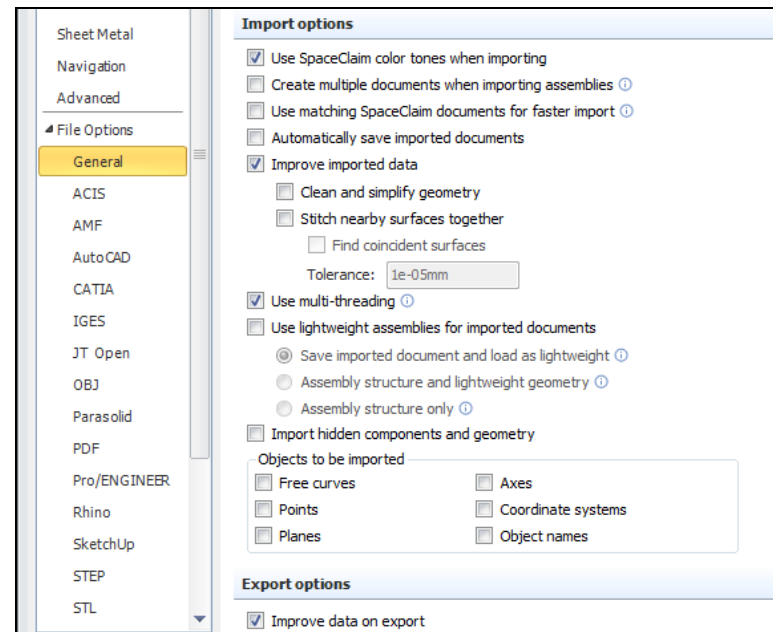
SpaceClaim files (*.sdoc)

- ACIS files (*.sat;*.sab)
- AMF files (*.amf)
- AutoCAD files (*.dwg;*.dxf)
- CATIA V4 files (*.model;*.exp)
- CATIA V5 files (*.CATPart;*.CATProduct;*.cgr)
- CATIA V6 files (*.3dxml)
- DesignModeler files (*.agdb)
- DesignSpark Files (*.rsdoc)
- ECAD files (*.idf;*.idb;*.emn)
- IGES files (*.igs;*.iges)
- Inventor files (*.ipt;*.iam)
- JT Open files (*.jt)
- NX files (*.prt)
- OBJ files (*.obj)
- OSDM files (*.pkg;*.bd;*.ses;*.sda;*.sdp;*.sdac;*.sdp)
- Parasolid files (*.x_t;*.xmt_bt;*.x_b;*.xmt_bin)
- PDF files (*.pdf)
- Pro/ENGINEER files (*.prt;*.xpr;*.asm;*.xas*)
- Rhino files (*.3dm)
- SketchUp files (*.skp)
- Solid Edge files (*.par;*.psm;*.asm)
- SolidWorks files (*.sldprt;*.sldasm)
- SpaceClaim Template Files (*.sdoc)
- STEP files (*.stp;*.step)
- STL files (*.stl)
- VDA files (*.vda)
- All Files (*.*)

Import Options

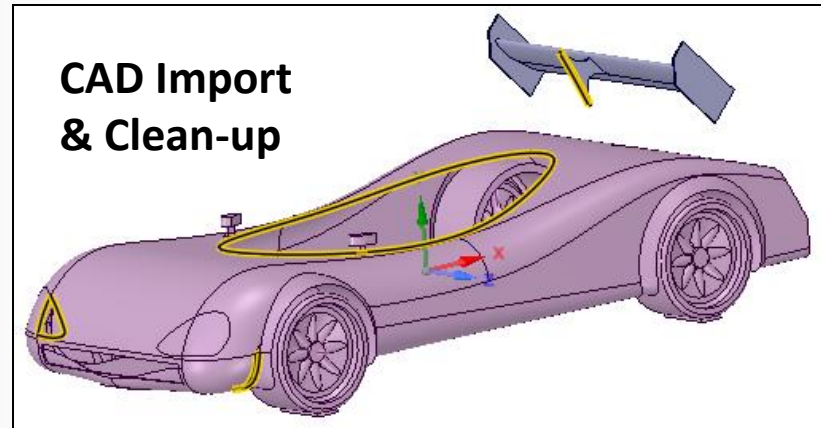
- There are advanced options available under SpaceClaim Options tab in File Menu
 - Useful for optimizing the importing and exporting process for your needs
- Several translation methods available to enable data exchange with CAD/CAE systems
 - Direct Integration/CAD Readers
 - Import of generic CAD formats (IGES, ACIS etc)
- Parameters, Named Selections, and Attributes can not be passed from CAD to SpaceClaim as SpaceClaim uses reader mode for all CAD files.
- Enclosure and Symmetry Processing is not available
- Work points (construction points) are not transferred

SpaceClaim Options



Why the Need for Repair?

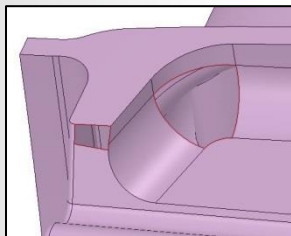
- Translation can:
 - Return incomplete, corrupt, or disconnected geometry
 - Requires repair
 - Return geometry details unnecessary for CAE analysis
 - Requires defeaturing
- These issues must be fixed to
 - Create watertight fluid bodies
 - Prevent meshing issues



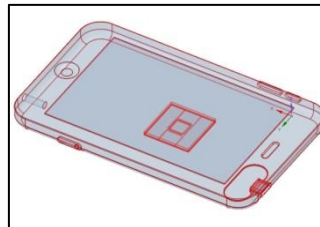
Common Issues Found in Geometry

- Many potential issues
 - Missing faces
 - Small faces
 - Free faces
 - Sharp angles
 - Overdetailed features
 - Hard edges
 - Small edges
 - Others ...
- These problems can be fixed using several tools available under "Repair" menu

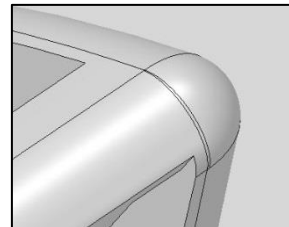
Missing Faces



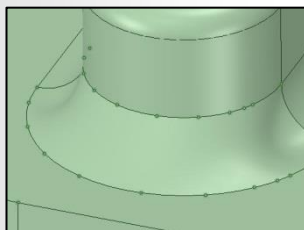
Free Faces



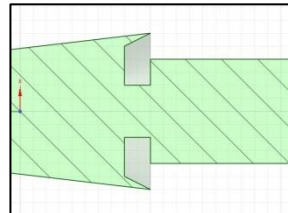
Small Faces



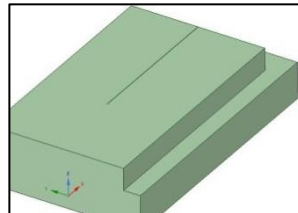
Small Edges



Sharp Angles



Hard Edges



- **Stitch**

- The **Stitch** tool combines surface part faces that are touching at their edges

- **Tool Guides Options**



Selects the location to repair one-by-one



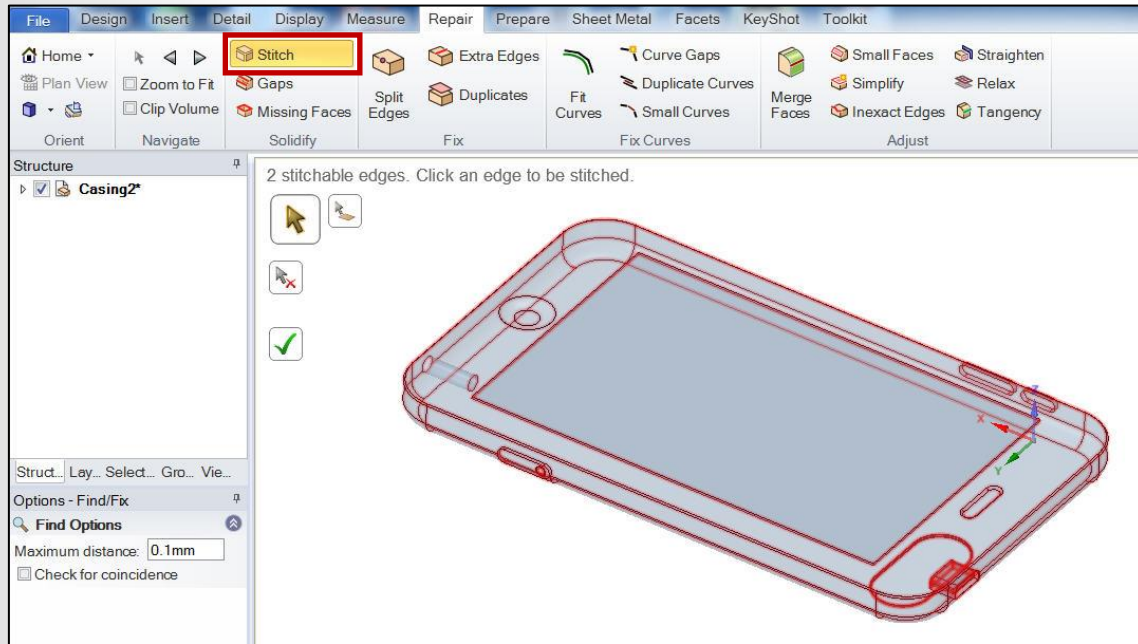
Select and add locations to auto selection



Removes the location from selection

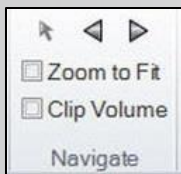


Repair all locations at a time

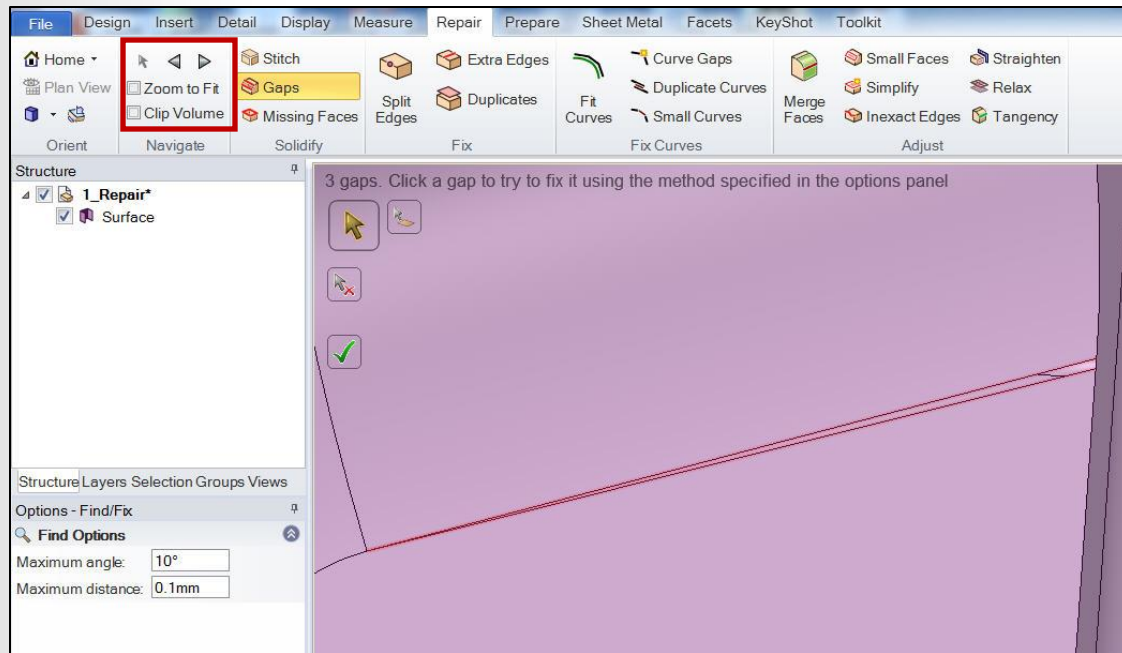


- **Gaps**

- The Gaps tool removes gaps between faces
- Use the controls in the Navigate ribbon group to view each problem one at a time before you fix it

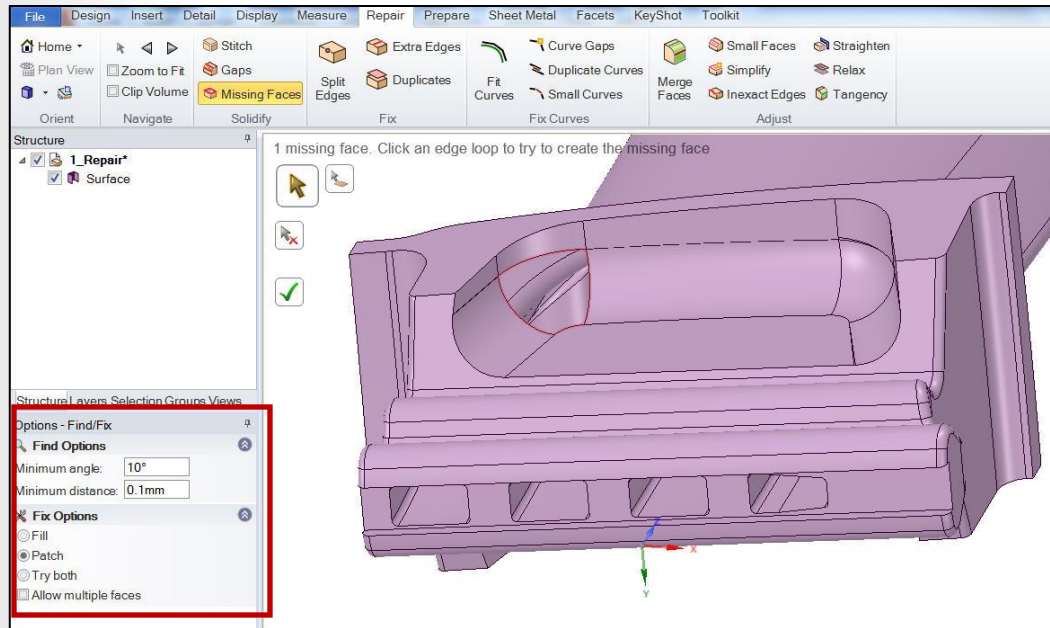


- Click “Next” or “Previous” to step through and highlight each identified problem
- Select “Zoom to Fit” if you want to automatically zoom in on the problem



- **Missing Faces**

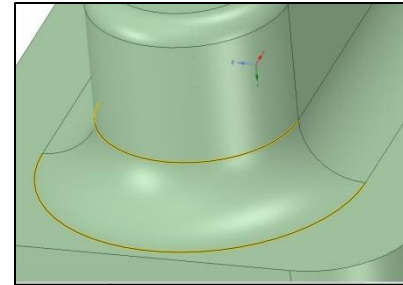
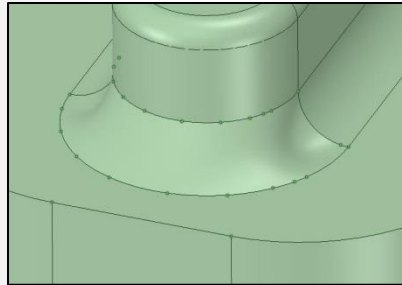
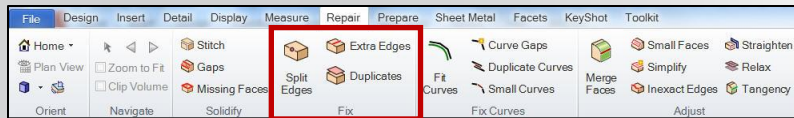
- This tool automatically detects and fills missing faces of an object
- This can fill the missing faces all-by-one or one-by-one
- Find Options
 - Set criteria for auto problem selections
- Fix Options
 - Different approaches to fill the missing faces



Common Issues Found in Geometry

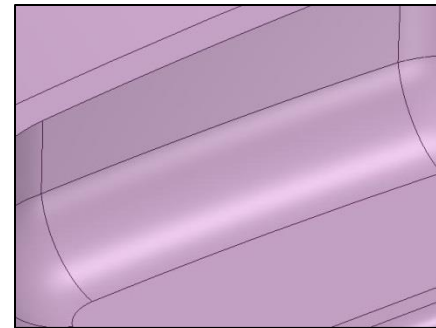
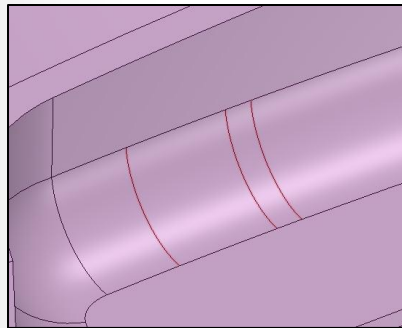
- **Split Edges**

- The Split Edges tool detects and merges coincident edges that do not mark the boundaries of new faces



- **Extra Edges**

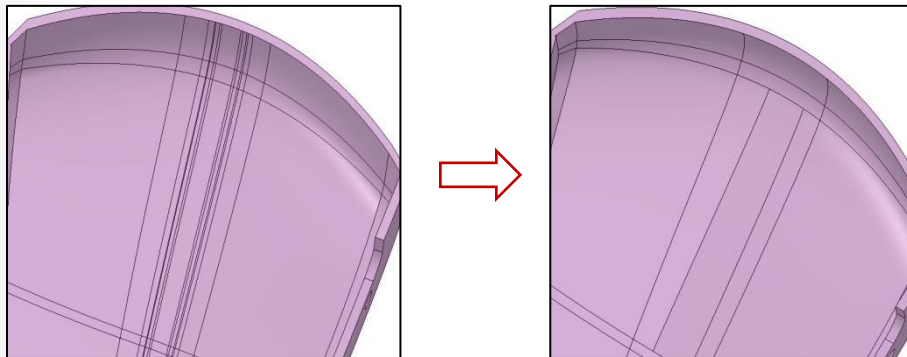
- The Extra Edges tool works like Merge Faces but removes the edges between the faces
- Merging faces simplifies the model by removing edges and makes the model more difficult to modify



Common Issues Found in Geometry

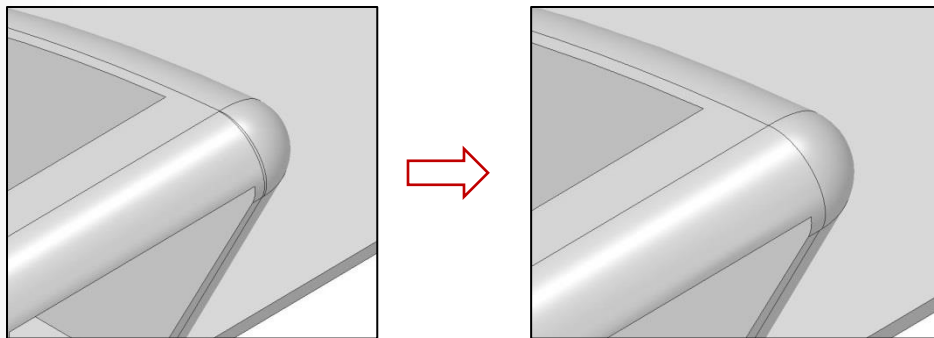
- **Merge Faces**

- The Merge Faces tool replaces two or more neighboring faces with a single new face that closely fits the original faces



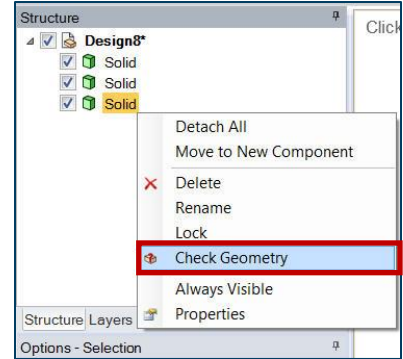
- **Small Faces**

- The Small Faces tool detects and removes small and sliver faces

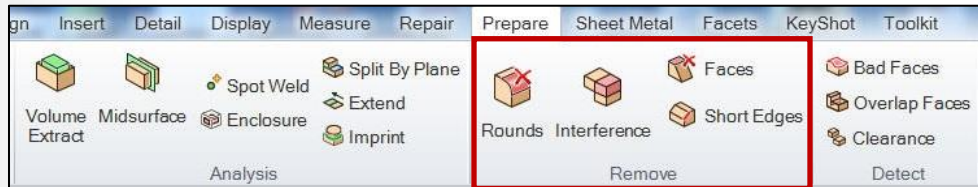


Fix Issues One-by-One Vs All-at-Once

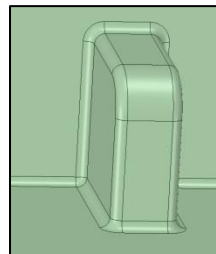
- SCDM allows fixing issues found at all locations at the same time
- This is useful when repairing large models
- But while fixing it may create invalid patches (surfaces) in the geometry
- It is advisable to double-check the locations fixed by automatic operations
- Check Geometry tool can be effectively used to validate the fixes



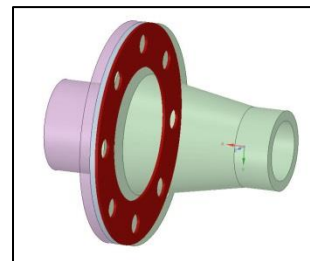
- Actual designs created have lot of features which are unnecessary for CAE analysis
- These features can be simplified using several Remove tools available under Prepare tab
- Specialized tools are used to remove features
 - Rounds
 - Interferences
 - Faces
 - Short Edges



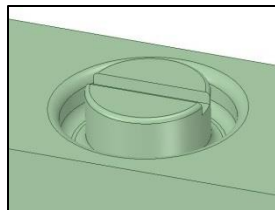
Rounds



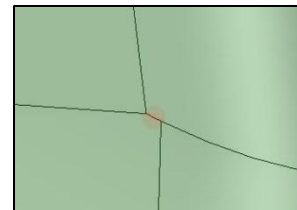
Interference



Faces

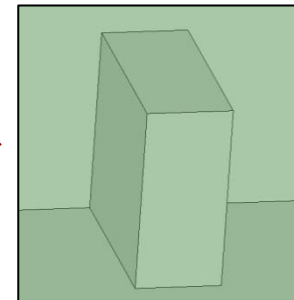
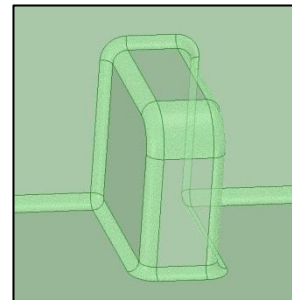


Short Edges



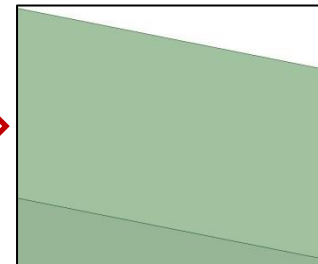
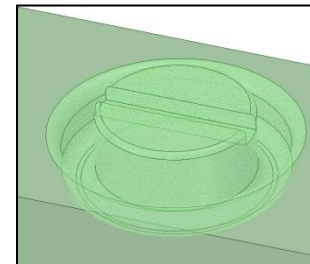
- **Rounds**

- It is similar to the Fill tool, except it only selects rounded edges
- You will have a greater chance of success if you remove only a few rounds at a time



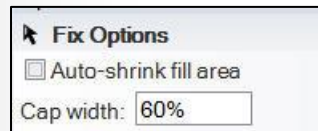
- **Faces**

- The Faces tool allows you to quickly remove faces from your design. Use it to simplify your design by removing holes, protrusions, etc.

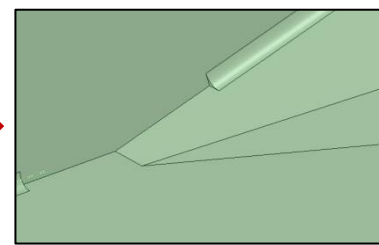
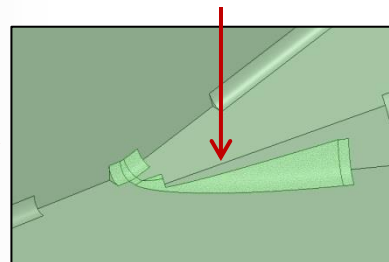
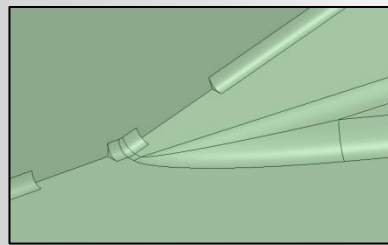
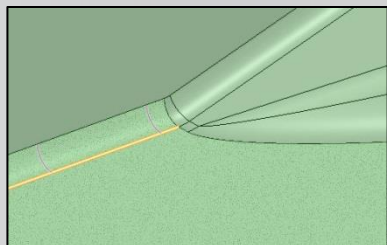


ANSYS® Specialized Tools

- Split and partially remove a round:
 - When a chain of rounds cannot be filled in its entirety, the rounds will be partially removed
 - Click on the edge to split the rounded face
 - From the Fix Options panel, change the Cap width option to adjust the percentage of the round face that is removed



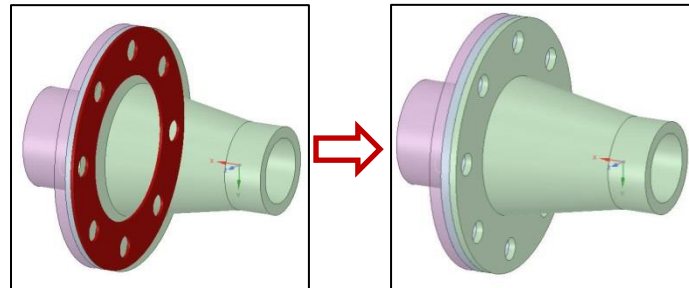
Use “Faces” tool to remove remaining part of fillets



ANSYS® Specialized Tools

- **Interference**

- The tool searches all visible bodies for interference
- The interference is removed from the body with the largest volume



- **Short Edges**

- This removes the small edges coincident with boundary edges
- It connects the two vertices of the short edge to eliminate it

