... within Epsilon

Twin Cities
ANSYS® User Meeting

April 2014

Workbench v15 Update

... within Epsilon

Agenda

1. Usability Improvements
2. New Features
3. Design Modeler Enhancements
4. V14 reminders

Usability Improvements

Shortcut Keys

Hotkeys

Design Modeler, Only

Ctrl+ **N**: **New** Model
Ctrl+ **O**: **Open** File
Ctrl+ **S**: **Save** Project

Ctrl+ **C**: **Copy** (Sketch mode)
Ctrl+ **V**: **Paste** (Sketch Mode)
Ctrl+ **X**: **Cut** (Sketch Mode)

Ctrl+ **Y**: **Redo** (Sketch Mode)
Ctrl+ **Z**: **Undo** (Sketch Mode)

Ctrl+ **E**: Select **Edges**
Ctrl+ **F**: Select **Faces**
Ctrl+ **P**: Select **Points**
Ctrl+ **B**: Select **Bodies**
Ctrl+ **A**: Select **All**

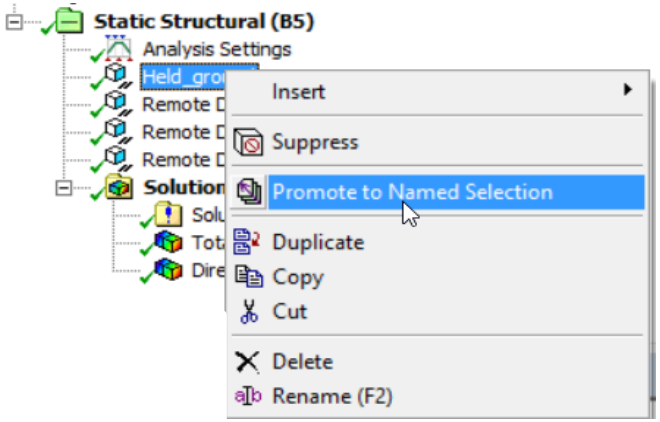
F8 **Hide Face**
F9 **Hide body**
Ctrl+ F8 Hide **Other Faces**
Ctrl+ F9 Hide **Other Bodies**
Shift+ F8 **Show All Faces**
Shift+ F9 **Show All Bodies**

F1: Help
F2: Rename
F3: Apply
F4: Cancel
F5: Generate
F6: Toggle Wireframe
F7: Zoom to Fit

Ctrl+ **+**: **Expand** Face Selection
Ctrl+ **-**: **Shrink** Face Selection
Escape: New Selection

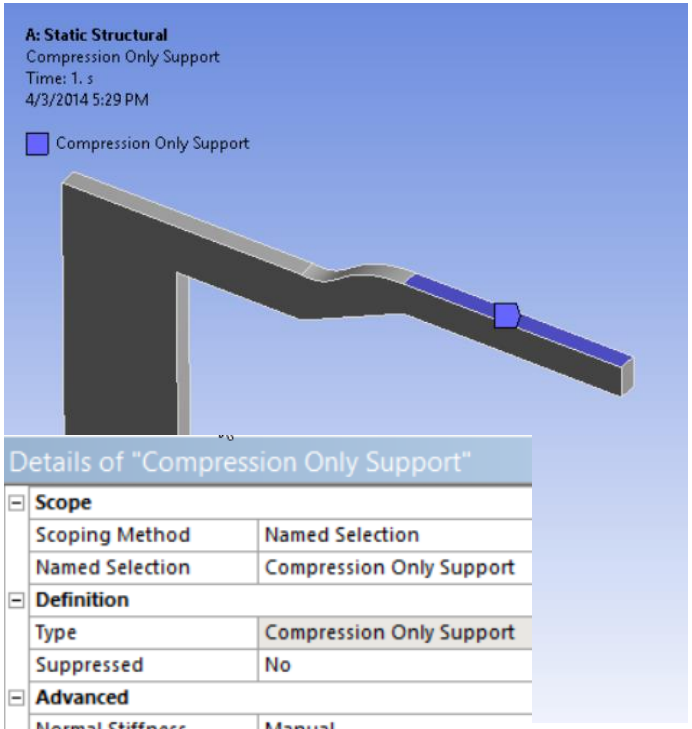
Preprocessing

- Promote a scoping to a named selection!
  - Consider making named selections the norm /best practice
  - For those who don't plan well...
- Cad materials can be assigned/ connected to WB material models
- Chaboche Hardening Curve Fitting
  - Plastic cyclic/hysteresis hardening
- New mapping processor
  - Can map stress/strain data from text file onto nodes
  - UV mapping algorithm (surfaces don't have to be coincident)
    - Projects data onto surface
    - Eases mapping from deformed to unreformed shapes!



Preprocessing

- Paths can start/stop on selected nodes!
  - Get "on surface" rather than above or subsurface
  - CS's just recently were scopeable to nodes
- Import .cdb's and meshes directly
  - Node/Element data only
  - Combine multiple analyses/assemblies
- Compression Only Support
  - Specify FKN, Updating Stiffness
  - Essentially a flat "rigid target" TSHAPE
  - I expect more features are coming
    - like offset surface!



Details of "Compression Only Support"

Scope	
Scoping Method	Named Selection
Named Selection	Compression Only Support
Definition	
Type	Compression Only Support
Suppressed	No
Advanced	
Normal Stiffness	Manual
Normal Stiffness Factor	1.e-002
Update Stiffness	Each Iteration

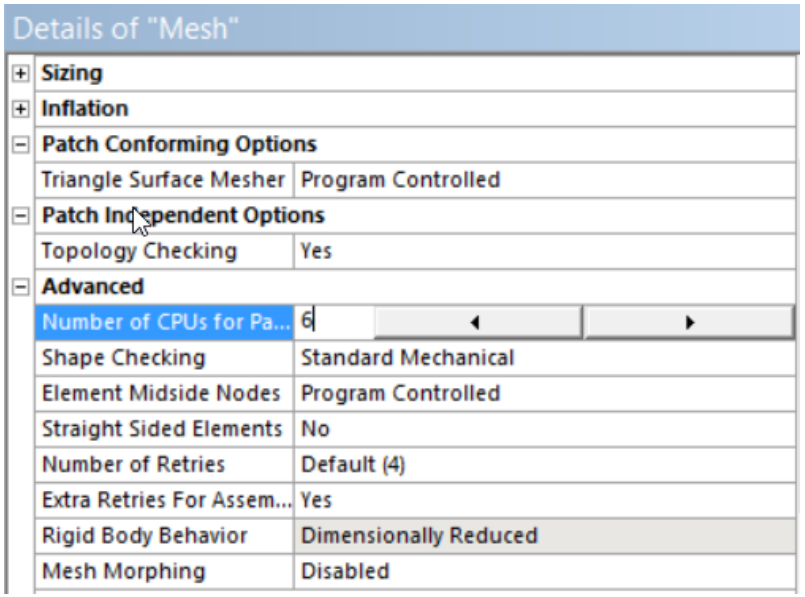
Import / Compare Parts

- Compare parts on update
  - New tolerance setting
- Can save remeshing / can improve part recognition for non-topological changes

15	Advanced Geometry Options	
16	Analysis Type	3D
17	Use Associativity	☑
18	Import Coordinate Systems	☐
19	Import Work Points	☐
20	Reader Mode Saves Updated File	☐
21	Import Using Instances	☑
22	Smart CAD Update	☐
23	Compare Parts On Update	Associatively
24	Compare Parts Tolerance	Loose
25	Enclosure and Symmetry Processing	Loose Normal Tight
26	Decompose Disjoint Geometry	

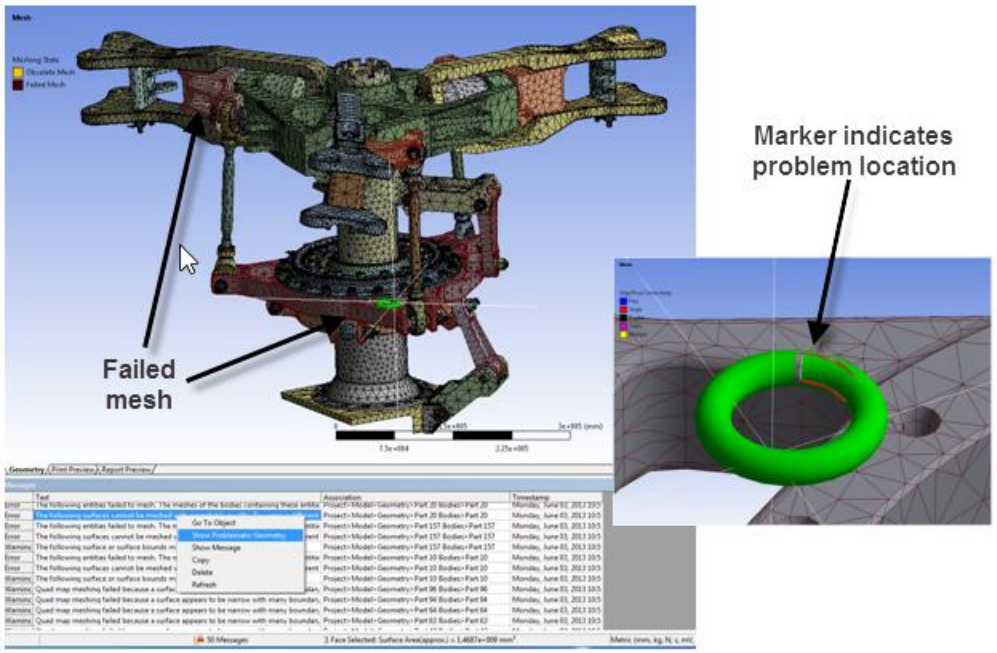
Parallel Meshing

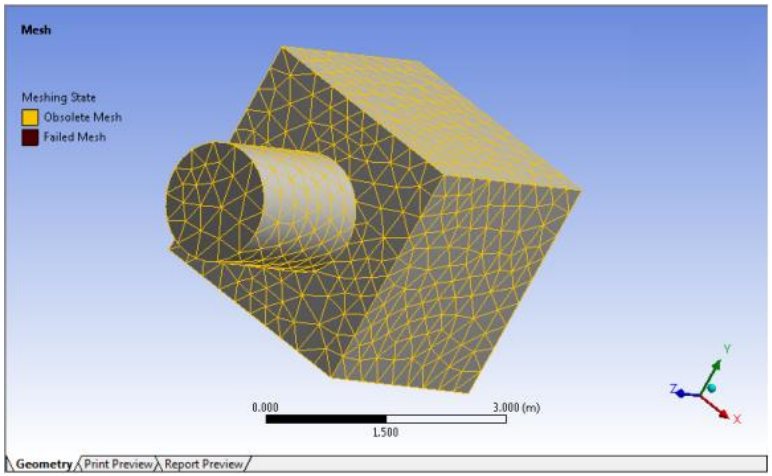
- Nearly linear speed up for multi-core machines
  … If you have a lot of bodies (not parts)
  - Must be Windows X64
  - Can't use "contact sizing" or "refinement" and a few others
  - Specify processors in options (use <n-1 or less)
  - Recommends turning off hyperthreading



Meshing

- Local Min-Size meshing
  - Overrides min-size in advance meshing (proximity and/or curvature)
- Mesh failures are color coded / highlighted by white axes

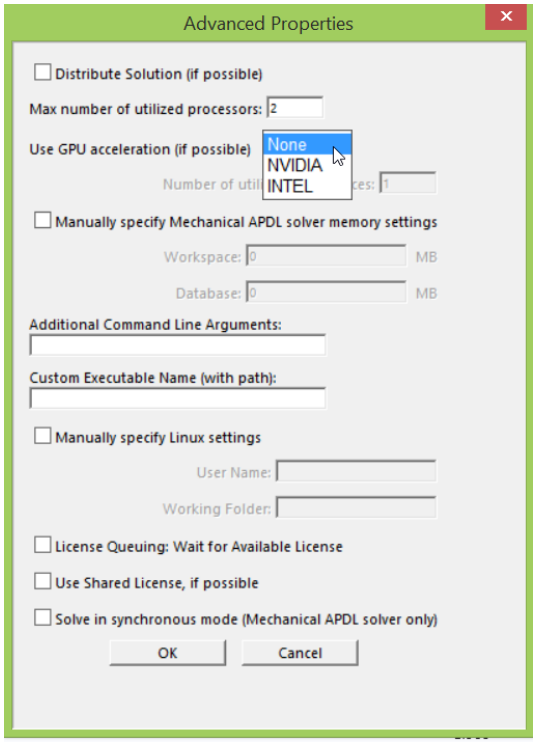




Images from help manual

Solver Improvements

- New distributed modal extraction
  - Scales beyond 12 cores for speed
- Can specify which modes to expand (modal)
- GPU added to solve process settings / GUI
  - Can have 1 GPU on SMP using Sparse now
- Multiple download attempts from remote solve manager!
- New Arc-length methodology
  - Now based on “Crisfield“ theory
  - Less likely to retrace own steps backward
  - Supposed to do better with plasticity



Solver Improvements

- NROPT,UNSYM exposed in WB
  - Can aid help with non-convergence/unstable problems
  - More expensive computationally (30% on solve time?)
  - Can use the WB/Mechanical generated springs
- Sparse has better detection/handling of singular matrices.
  - PIVCHECK command can be disabled.
- Spectrum DDAM with CSM (closely spaced modes)
  - More conservative mode combination method
- Explicit dynamics now set to always use double-precision

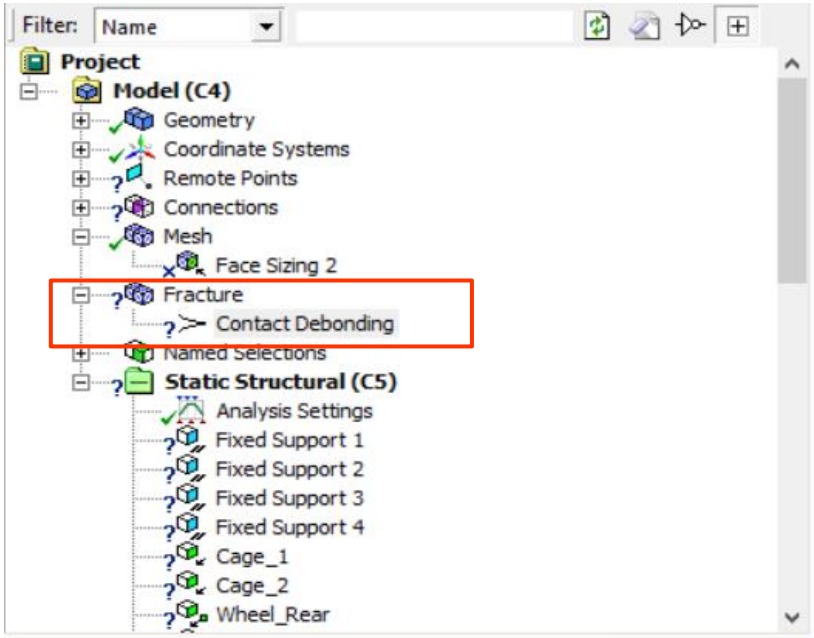
Post-Processing Improvements

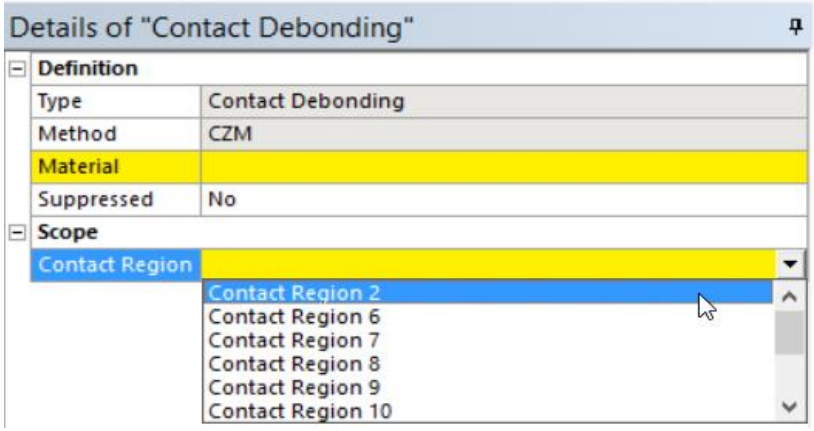
- Average results across bodies
- Us MXPAND to specify significance levels for expansion of modes
- Default is to display only scoped bodies
  - Previously displayed selected, non-scoped bodies as transparent

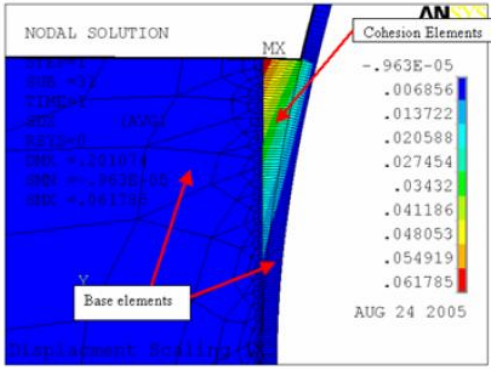
New Features

Contact Debonding

- Contact Debonding!
  - CZM technology
  - Uses CONT17X
  - Define material model
- Interface Delamination
  - uses INT20X elements
  - more complex separation functions







More Contact

- MAPDL Contact -- user-programmable definitions
  - Stiffness based on frequency, nonlinear, etc.
  - USERCNPROP and USERINTER
- FTOLN now affects FKN!!!!
- Contact surface wearing
  - “Archard” wear model (or user defined subroutine)
  - Moves contact node by depth of calculated wear
    - Controlled via material property, TB, WEAR
  - Total wear stored in NMISC data

Contact

- Bolt thread modeling
  - Need to have a refined mesh
  - Specify bolt axis/CS
  - Enter Pitch, Thread Angle, Diameter, etc.

Geometric Modification	
Interface Treatment	Add Offset, No Ramping
Offset	0. mm
Contact Geometry Correction	Bolt Thread
--Orientation	Program Controlled
--Mean Pitch Diameter	5. mm
--Pitch Distance	2. mm
--Thread Angle	60. °
--Thread Type	Single-Thread
--Handedness	Right-Handed

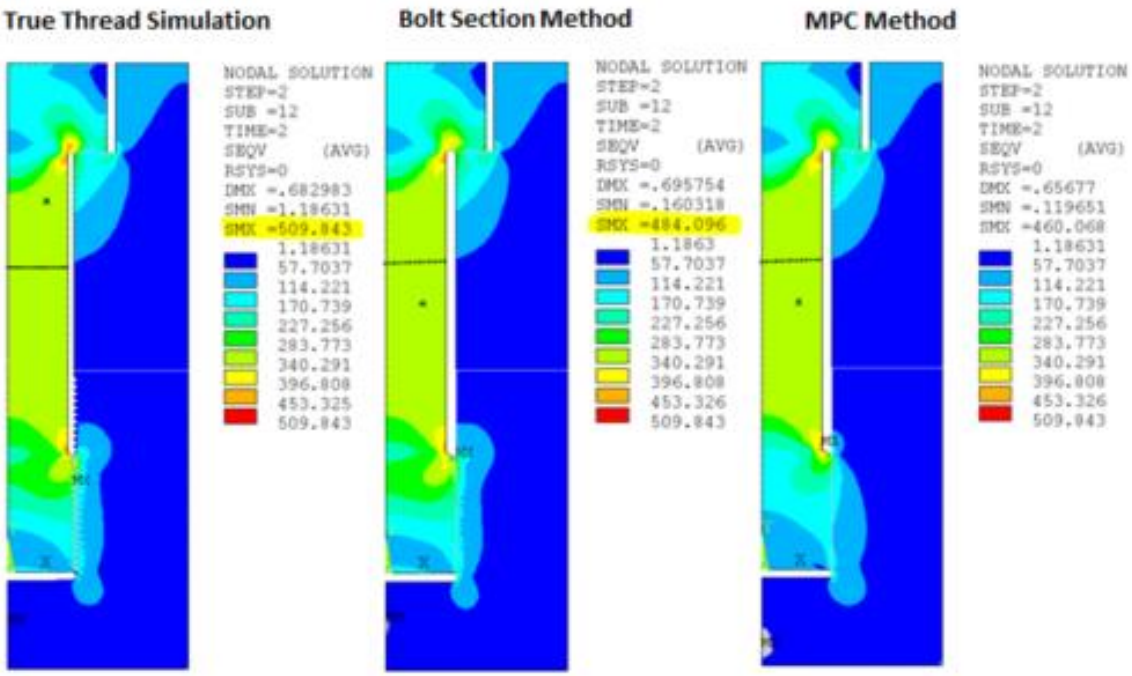


Image from help manual

Shell to Solid Submodels

- 3D shell model to 3D solid model
  - In “Transfer Key” specify Shell-Solid
    - Imported Loads detail window
  - As with most submodels, beware the rotating nodes CS’s
  - UY mapped for nodes within center region (20% the thickness)…
    - Beware over/under constraint here.
    - Ideally this would be a single set of nodes

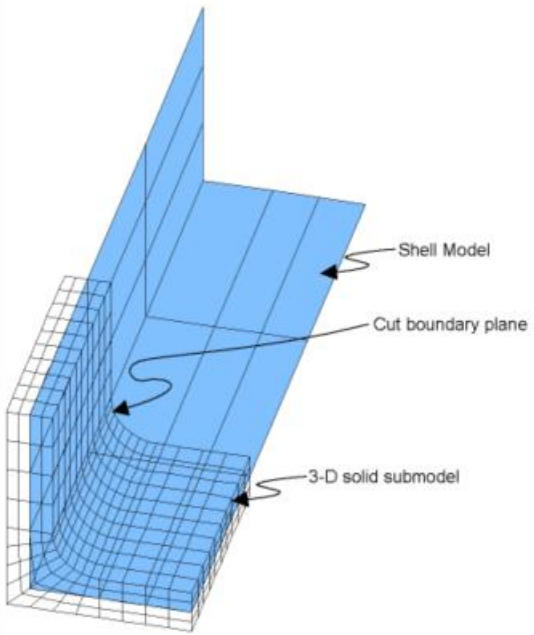
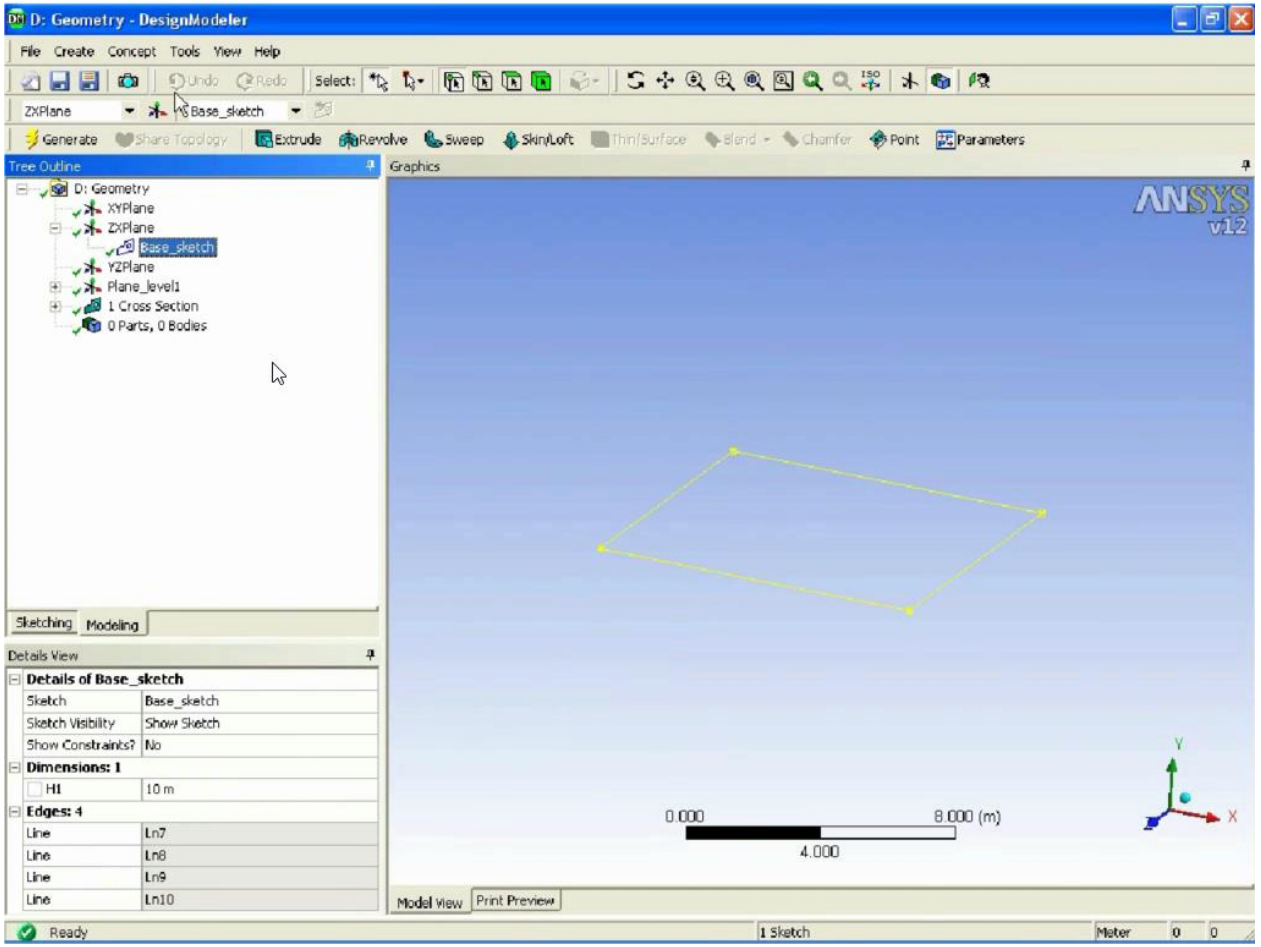


Image from help manual

Automatic Rezoning

- Manual Rezoning fully implemented in MAPDL
  - Writes deformed nodes
  - Makes facets/geometry in the deformed shape
  - Meshes new volume/area
  - Transfer displacements from previous analysis
  - Resolves -- Lather, rinse, repeat…
- Automatic Rezoning just splits the element edges
  - a.k.a. “Mesh Nonlinear Adaptivity”
  - An EREFINE essentially.
  - Manual is pretty clear this won’t help element shape distortion errors… yet.

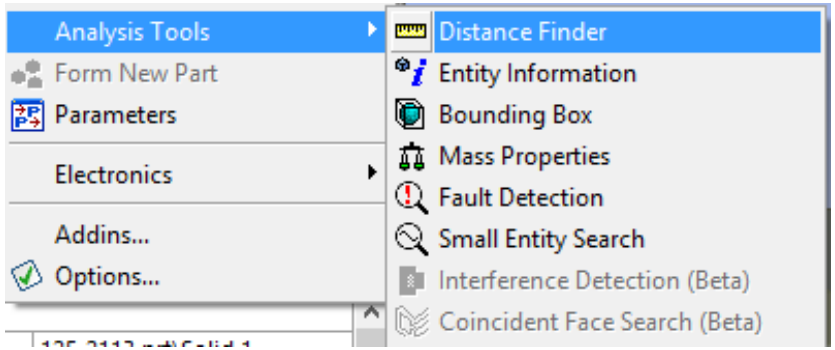
DesignModeler Updates

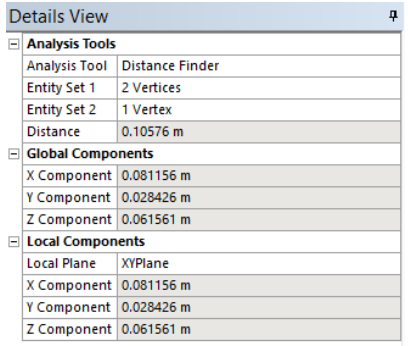


DesignModeler Updates

- DM, units changeable in session -- Gadzooks!!!
- Section planes in DM --- Holy Moley!

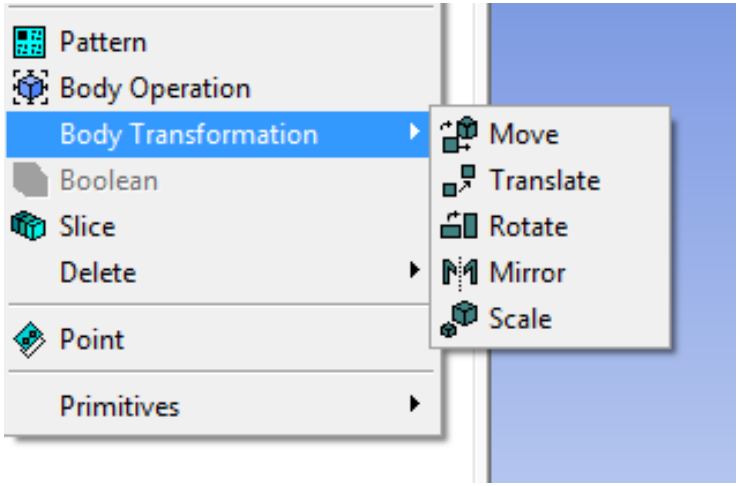
- XYZ distances (see distance finder utility) – Egads!
  - Specify the CS!



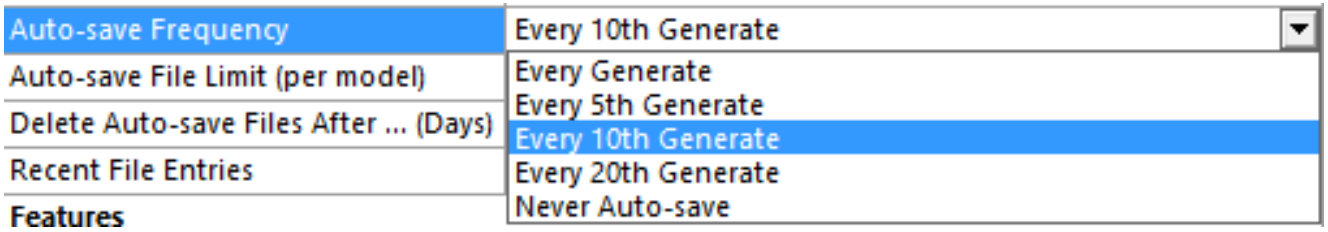


DesignModeler Updates

- Body Operations / Moves are Organized



- Auto-save can now be 10th, or 20th!



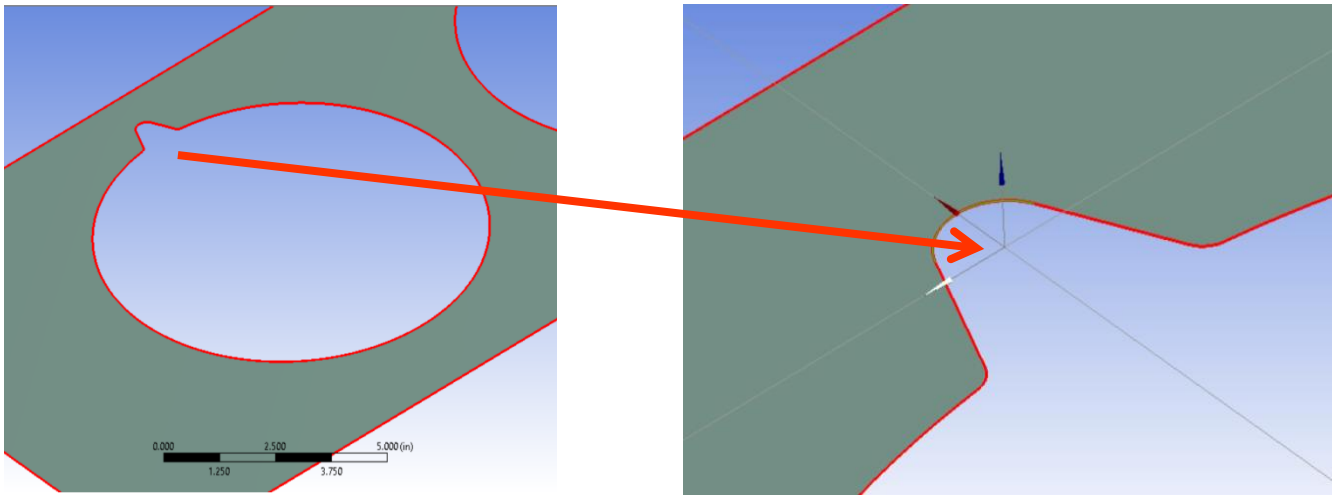
DesignModeler Updates

- Body / Face / Edge Delete

- Can do a "clean operation" on specified bodies
  - Default on import is to clean everything
- Imprint faces works on frozen bodies
  - Avoids having to freeze/unfreeze things you don't want "melted" together.
- Can "Scale" body in 1 direction (aka non-uniform scaling)

DesignModeler Updates

- “Thin surface”, preserves bodies – more powerful than mid-plane extraction. Explore if you do shells, or CFD enclosures, etc.
- Can specify the curve to be center of CS



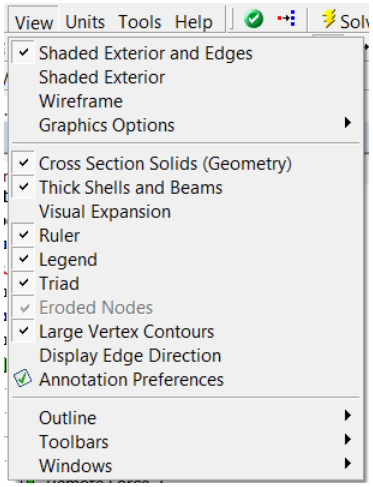
Shared Topology

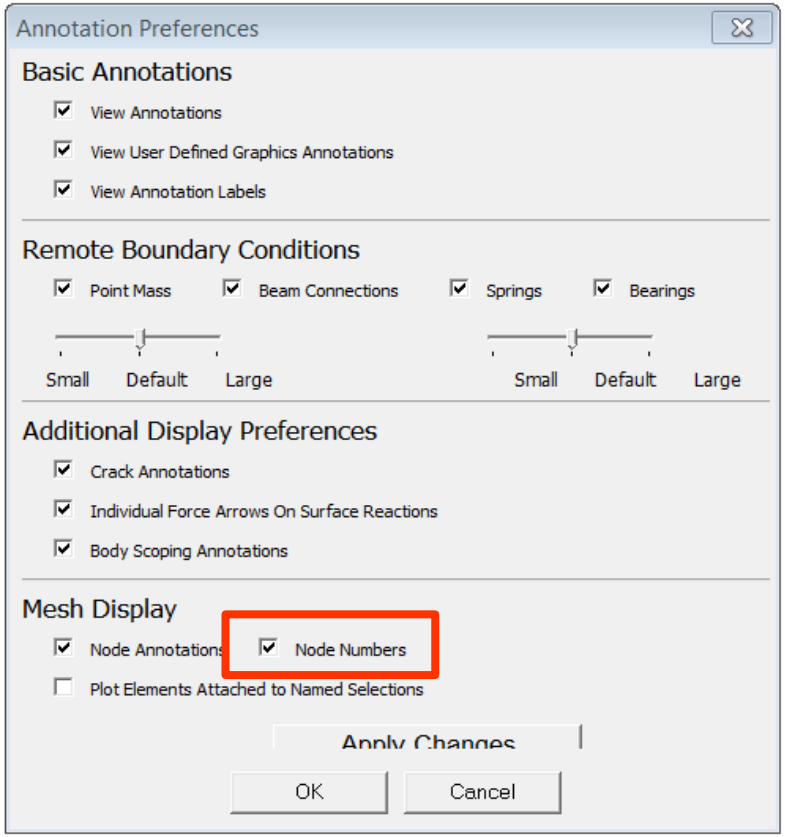
- Now way Faster!
- Toggles on/off – if you don't know about it, it's a must read to avoid problems.
  - Default is to execute behind the scenes on way to Mechanical
  - Can be forced to earlier location in the tree
    - And then hidden – so you won't know that it is happening prior to other operations!
- Face coloring by shared topology specification
  - Not by success / actual connection
- Specify face joints manually…
  - Must be two parts within same body
  - Can be done after shared topology operation

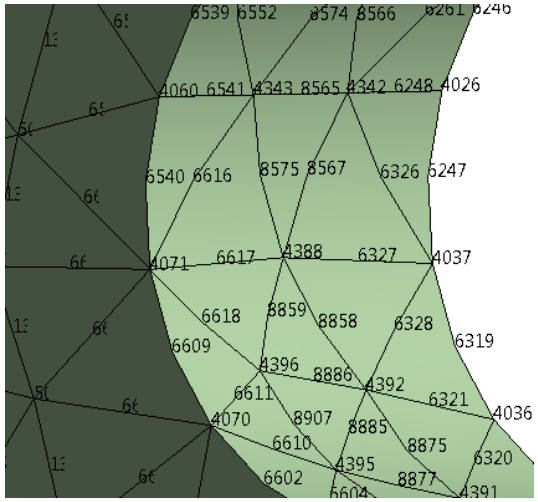
V14 - Reminders

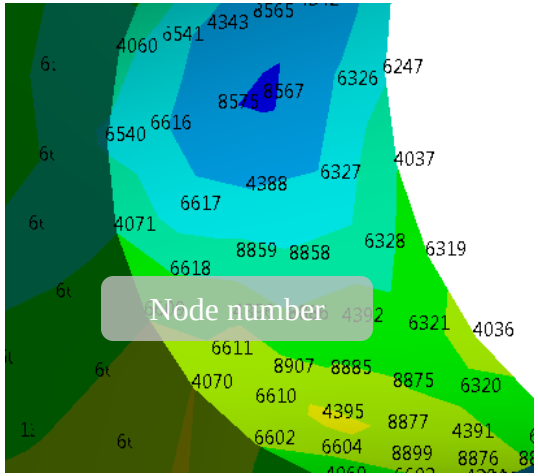
Annotations Control

- Some items updated
- Added display node number option



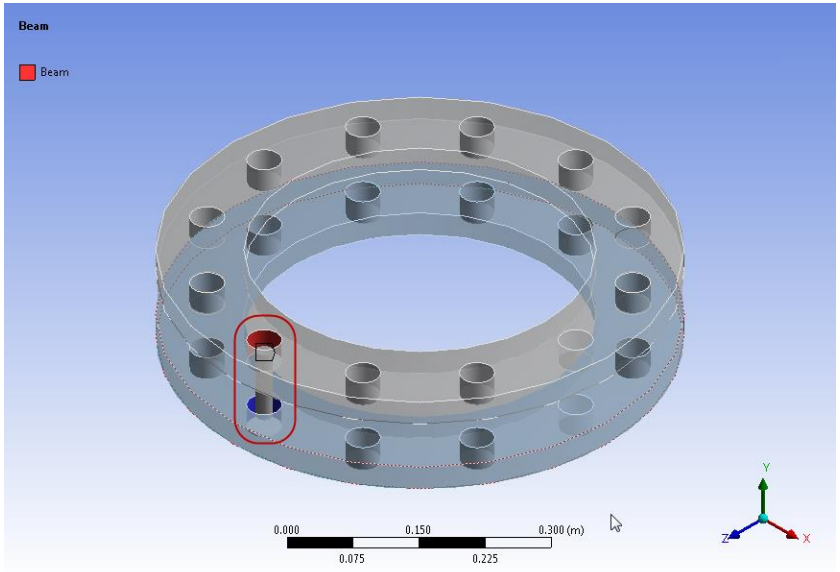






Pattern Generation Of Tree Items

- Object Generator to make one or more copies of a template object
  - any tree object that supports the “Duplicate” function can be used as a template.



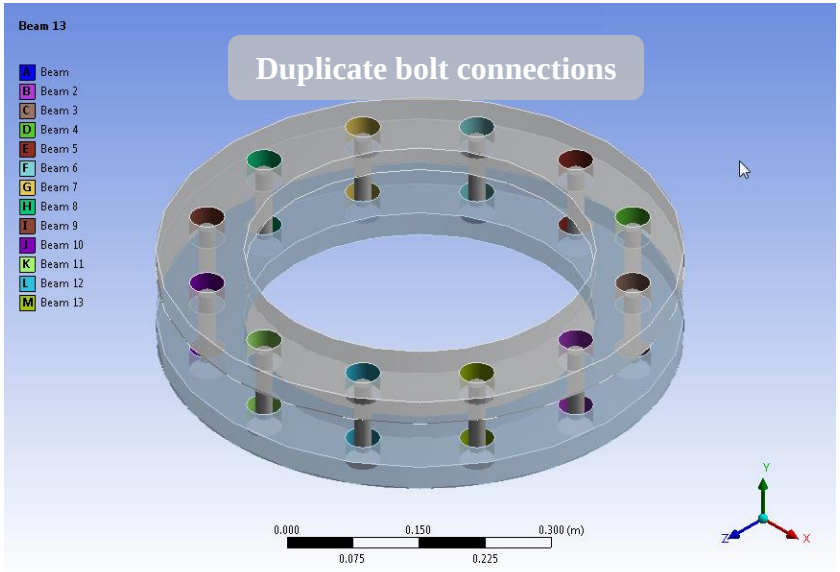
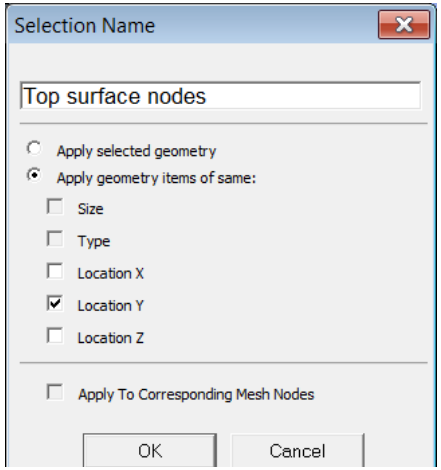
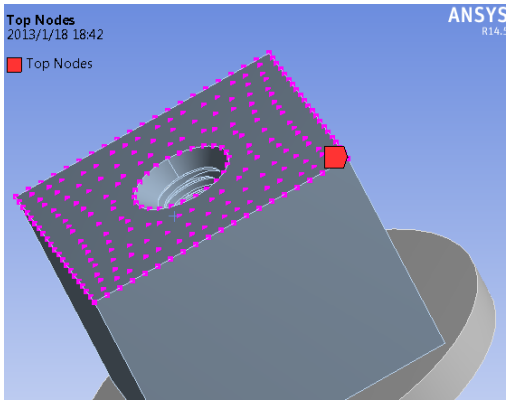


Fig From ANSYS Inc, 2012

Named Selections with Location

- Select with a distance from the origin of a selected Coordinated System
- Select Node, face, edge, etc





Generate

	Action	Entity Type	Criterion	Operator	Units	Value	Lower Bound	Upper Bound	Coordinate Sys...
☑	Add	Mesh Node	Location Y	Equal	mm	16.	N/A	N/A	Global Coordin...

Face
Edge
Vertex
Mesh Node

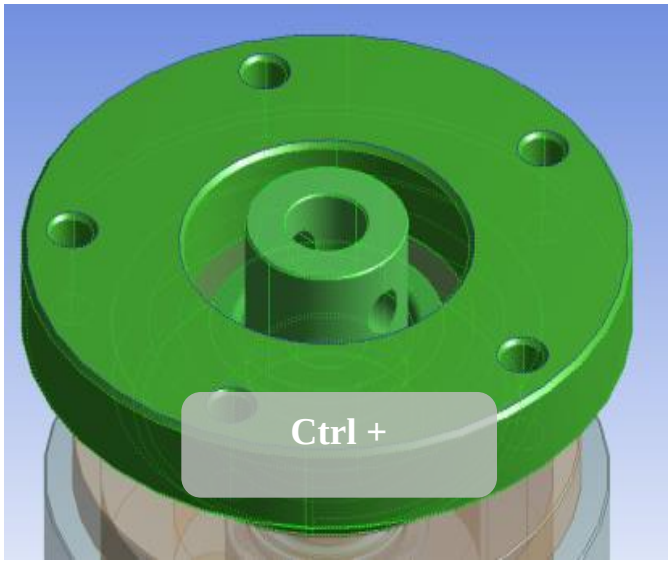
Generate

	Action	Entity Type	Criterion	Operator	Units	Value	Lower Bound	Upper Bound	Coordinate Sys...
☑	Add	Mesh Node	Location Y	Equal	mm	16.	N/A	N/A	Global Coordin...

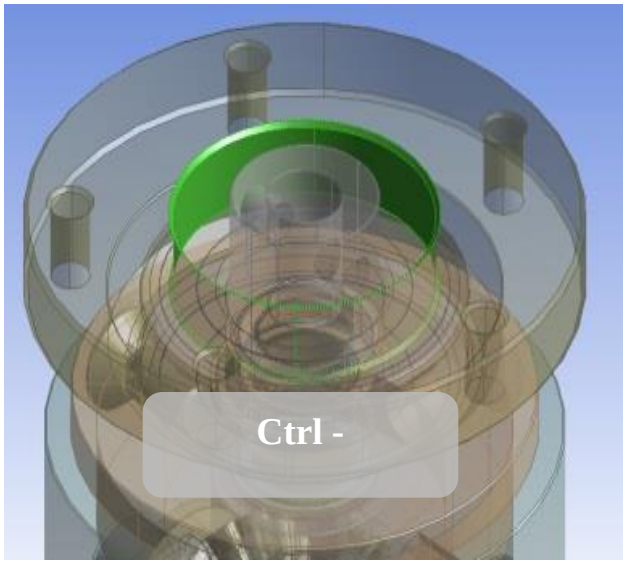
Equal
Not Equal
Less Than
Less Than or Ec

Hotkeys / Face Selection

- Hotkeys for face selection expansion/shrink (V14)

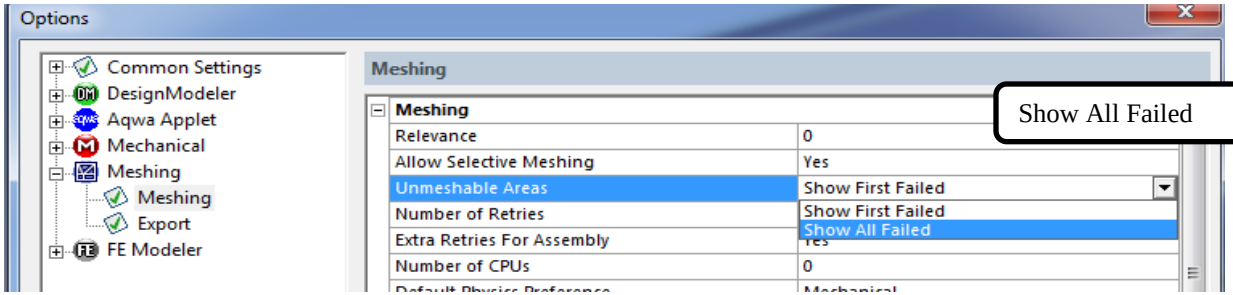


Expand

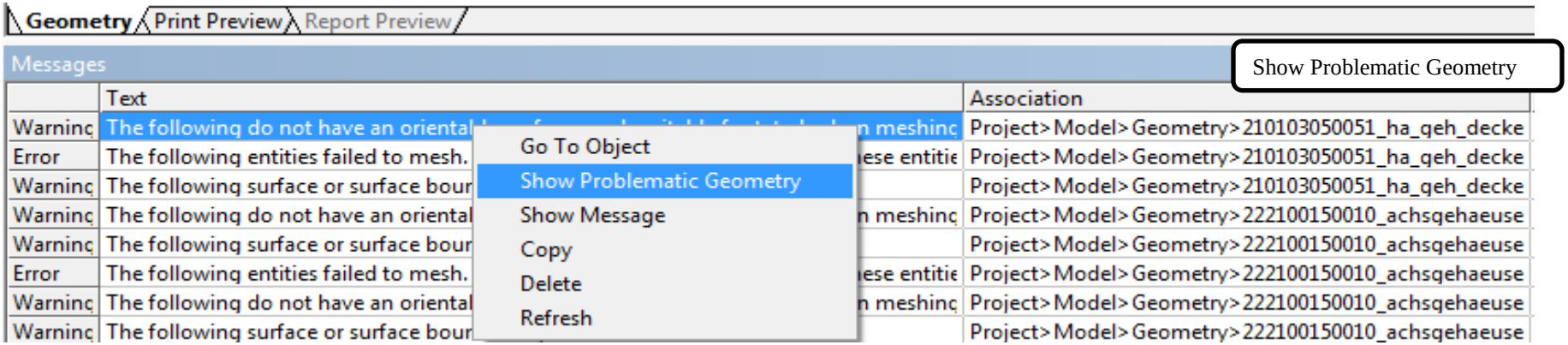


Shrink

Meshing: Robustness



- "Show All failed" improved in 14.5
  - All failed regions are listed for easier correction
  - Helps indicate if just a few problems or more significant

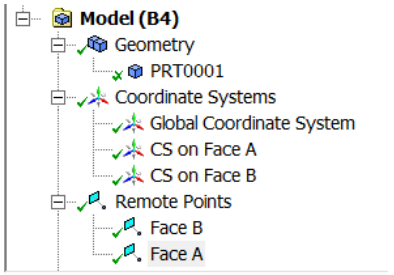


- >1000 meshing defects fixed:
  - In all technology areas, application areas, etc.

Fig From ANSYS Inc, 2012

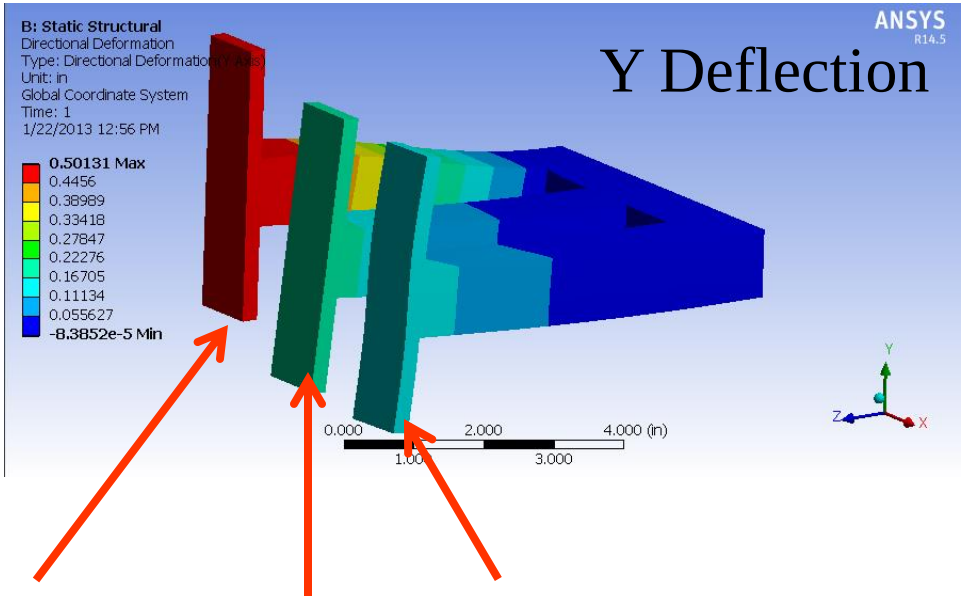
Coupled Remote Bc's

- Previously had Rigid/Deformable
  - Implemented through contact technology
  - Rotation behavior likely is not what you expect .
  - Displacement behavior can also not be what one expects
- Coupled Behavior for a Remote Point.
  - Implements by coupling all nodes together for applied BC direction
  - Rotations ignored/disabled

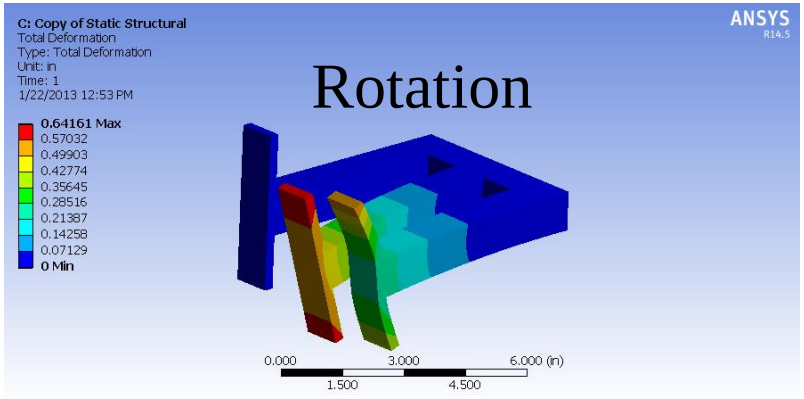


Details of "Face A"

Scope	
Scoping Method	Geometry Selection
Geometry	1 Face
Coordinate System	CS on Face A
X Coordinate	0. mm
Y Coordinate	30. mm
Z Coordinate	0. mm
Location	Click to Change
Definition	
ID (Beta)	64
Behavior	Coupled
DOF Selection	Program Controlled

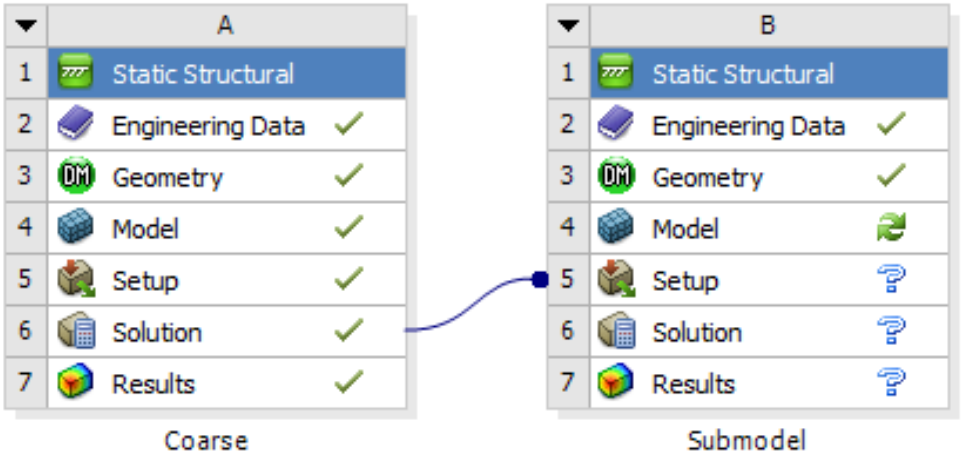


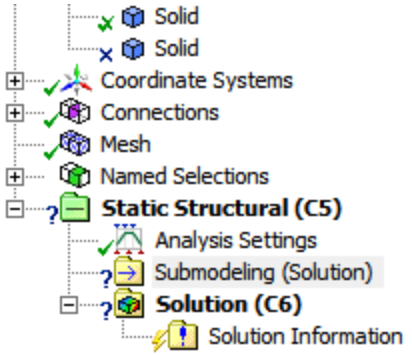
Coupled Rigid Deformable



Submodeling In WB

- Make coarse model
- Make submodel, dragging the solution from coarse onto submodel setup



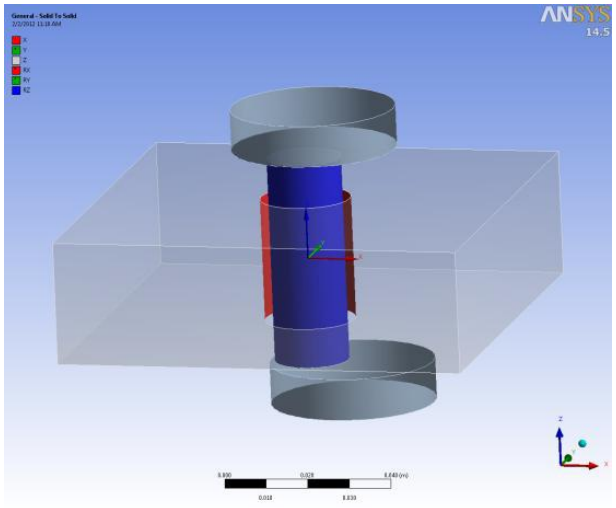


Radial gap stop as Contact

- Efficient modeling of small clearance between shaft and bearings are available for spherical, general and bushing joint and do not require full contact modeling

Details of "General - Solid To Solid"

Definition	
Connection Type	Body-Body
Type	General
Suppressed	No
Translation X	Free
Translation Y	Free
Translation Z	Fixed
Rotations	Free All
Reference	
Scoping Method	Geometry Selection
Scope	1 Face
Body	Solid
Coordinate System	Reference Coordinate System
Mobile	
Scoping Method	Geometry Selection
Scope	1 Face
Body	Solid
Initial Position	Unchanged
Stops	
Radial Gap	Stop
Inner Diameter	1.8e-002 m
Outer Diameter	2.2e-002 m
Height	3.e-002 m
Restitution	0.5



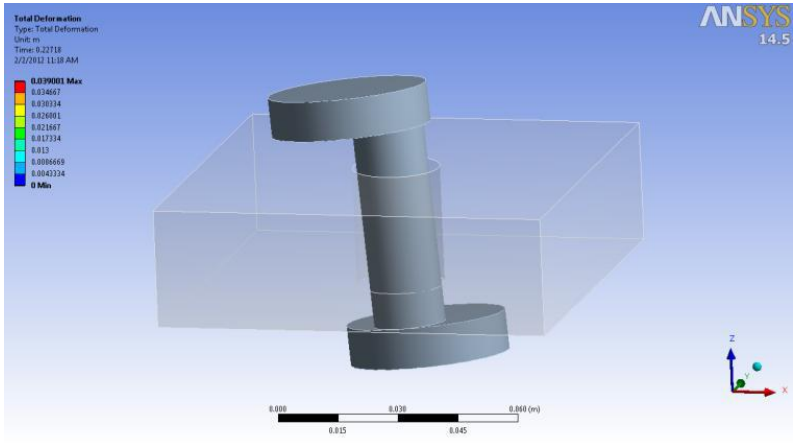
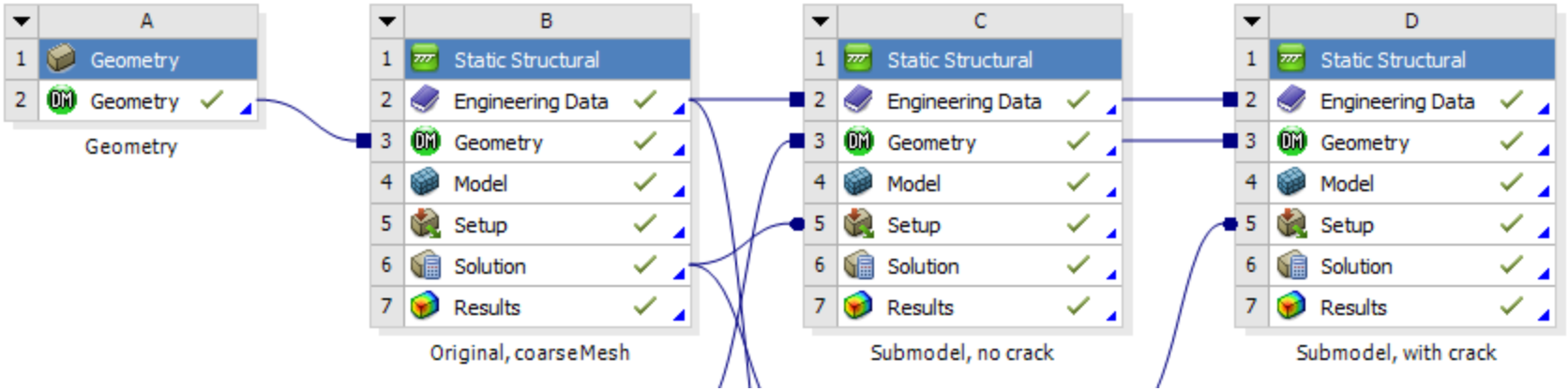
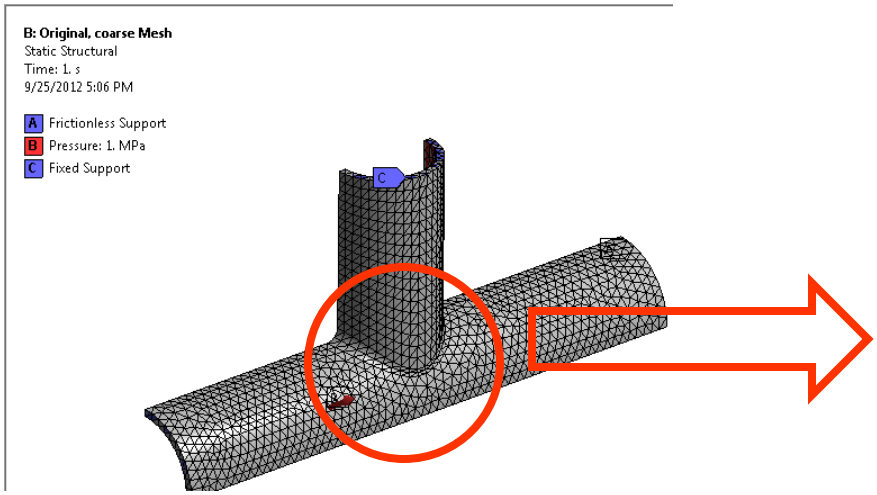


Fig From ANSYS Inc, 2012

Combine Submodeling And Crack Analysis

- A crack can be introduced in a submodel to reduce overall computation time while increasing the local accuracy.





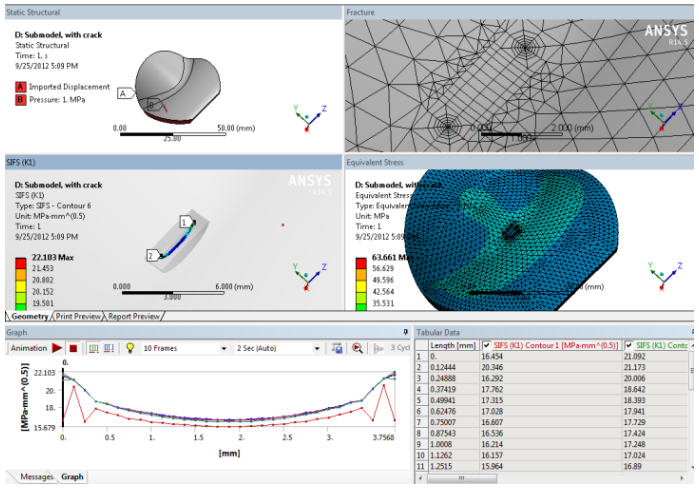


Fig From ANSYS Inc, 2012