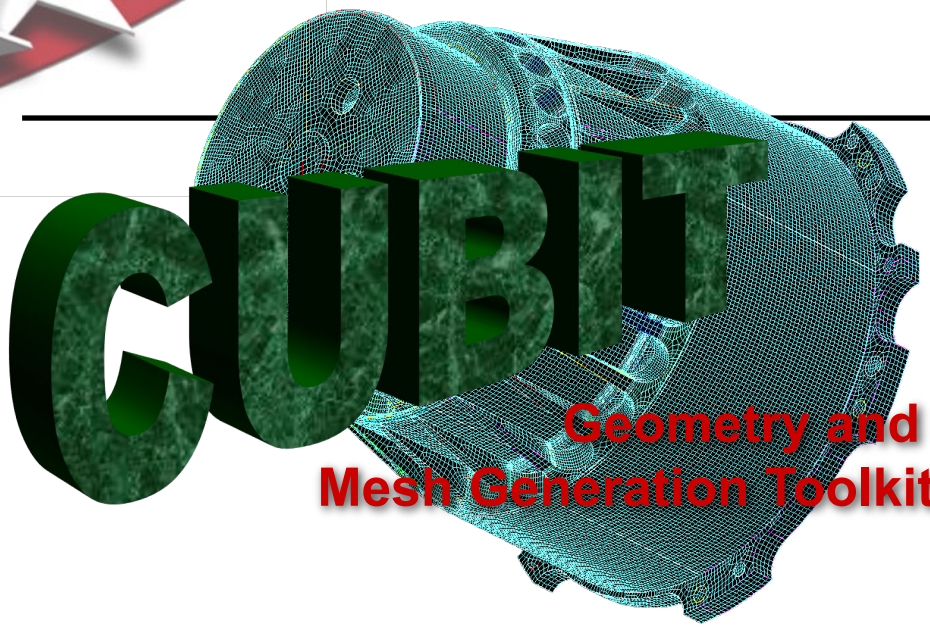


Simulation Modeling Sciences

CUBIT Fast-Start Tutorial

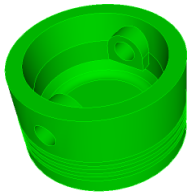
13. Defining the FEM for Non-Sierra Users

Sandia National Laboratories is a multi-mission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC., a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

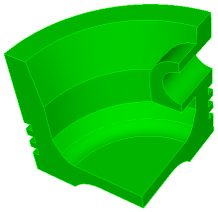
Sandia National Laboratories

The Basic CUBIT Process

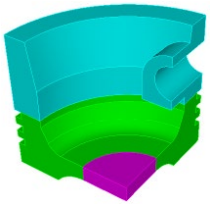
Simulation Modeling Sciences



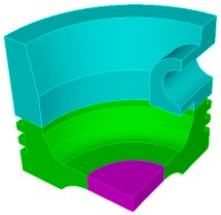
1 Import Solid Model



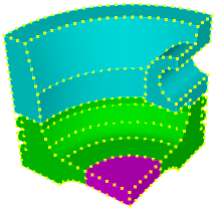
2 Simplify Geometry



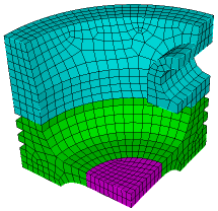
3 Decompose Geometry



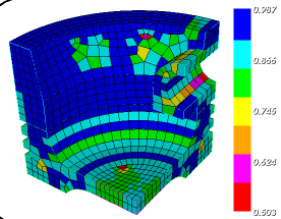
4 Imprint & Merge



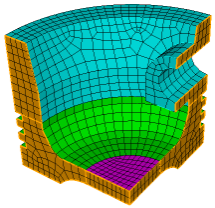
5 Set Schemes & Intervals



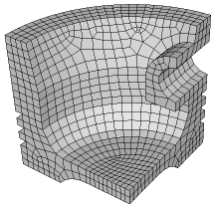
6 Mesh



7 Check Quality

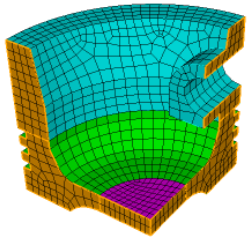


8 Apply B.C.s



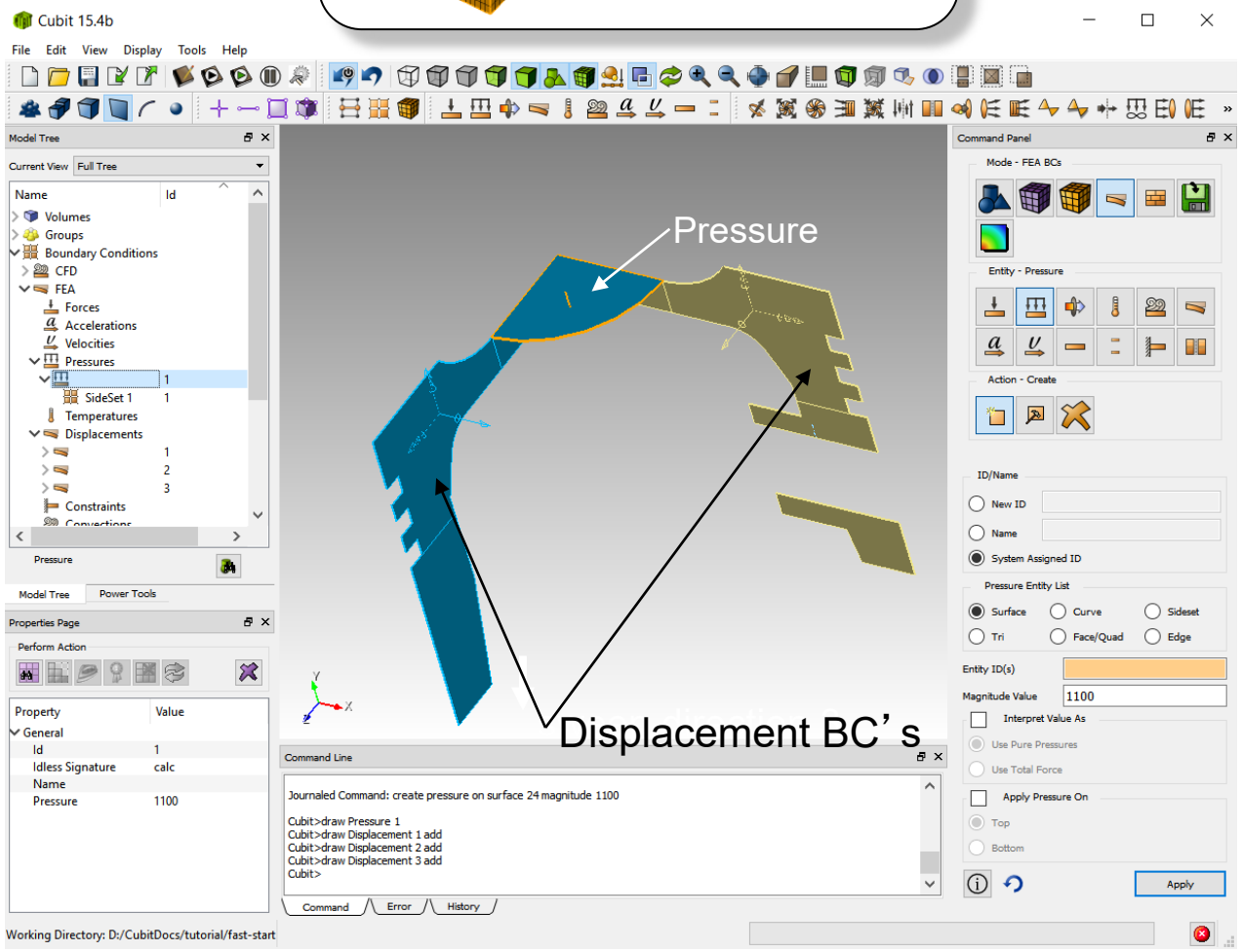
9 Export Mesh

Sandia National Laboratories



8 Apply B.C.s

Assign boundary condtions and material properties.



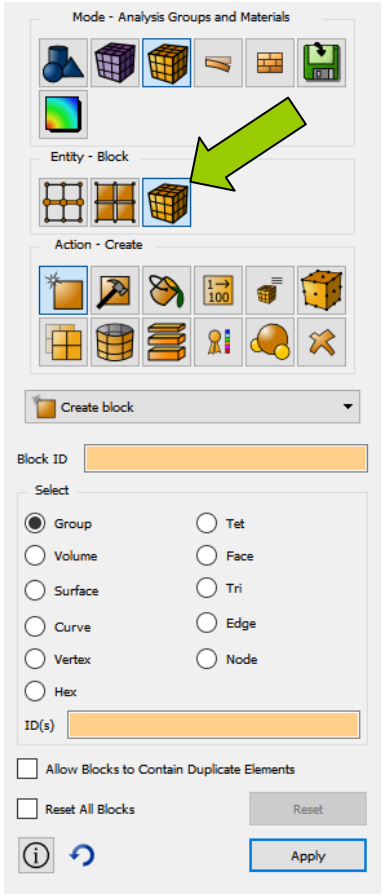
Materials and Boundary Conditions are applied

Sandia National Laboratories

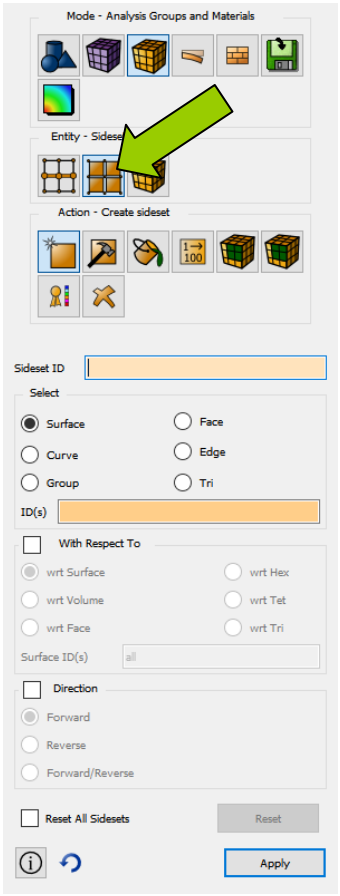
Exodus Grouping Mechanisms

The Exodus grouping mechanisms can also be used with non-Exodus based analysis codes.

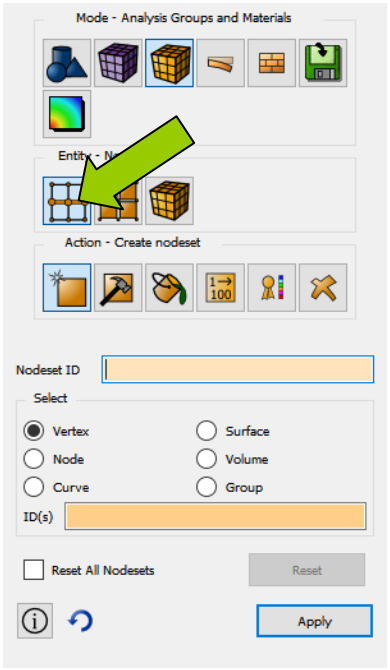
The grouping mechanisms can be referenced as the basis for defining boundary conditions on sidesets or nodesets or for defining material groups with blocks.



Blocks



Sidesets



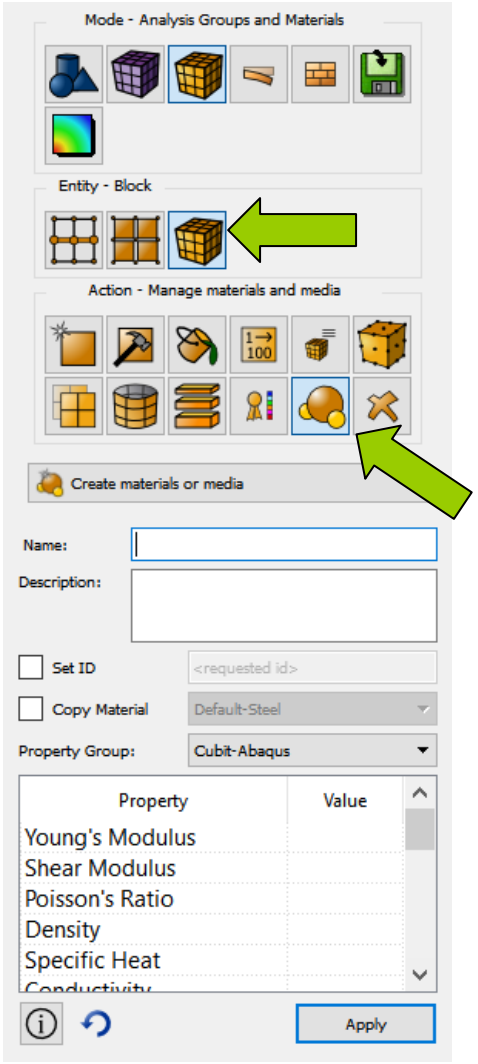
Nodesets

Material Definitions

Cubit allows for the definition of simple isotropic materials and CFD media.

The isotropic material is supported in Abaqus and LS-Dyna. It can be used as a place holder for more complex materials.

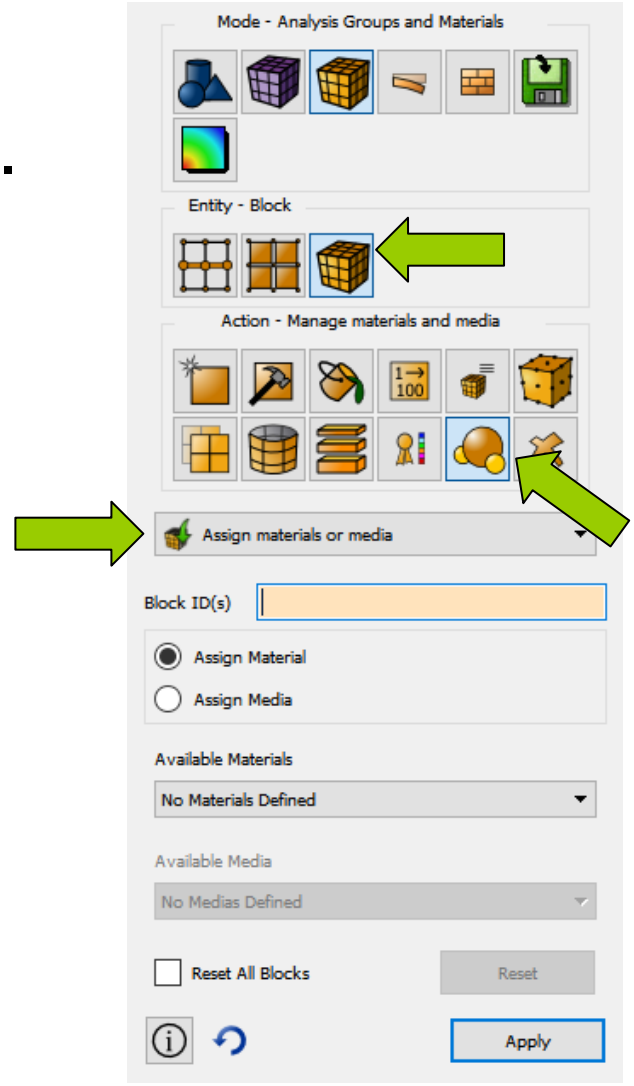
CFD media is used to define zones in Fluent and actual material properties are typically assigned in the Fluent set up application.



Assigning Materials to Blocks

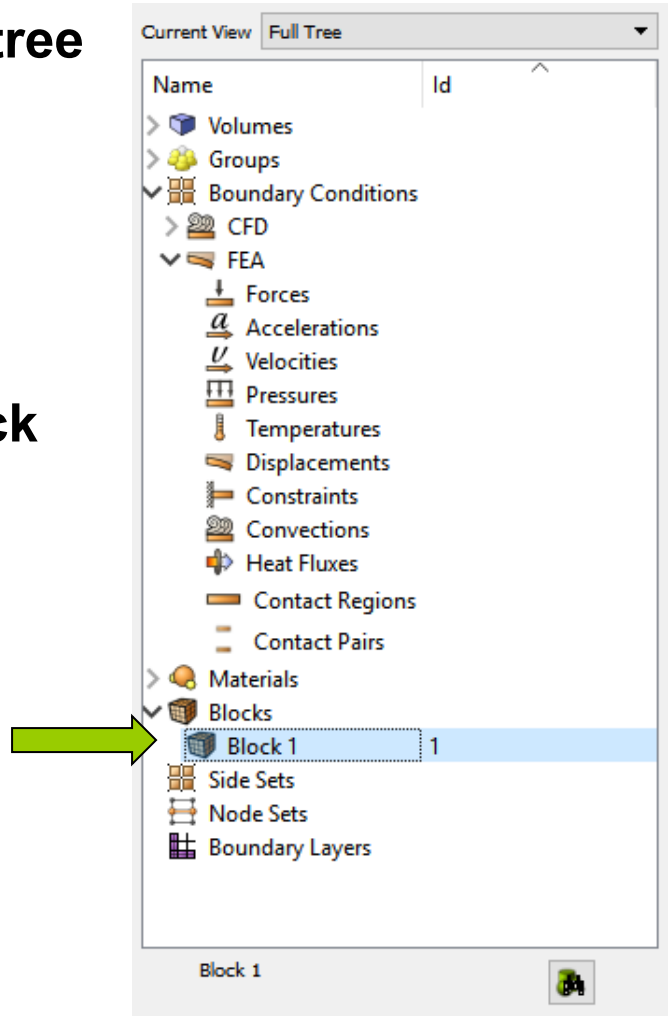
The same material can be associated with multiple blocks.

A material must be associated with at least one block for It to show up in the export file.



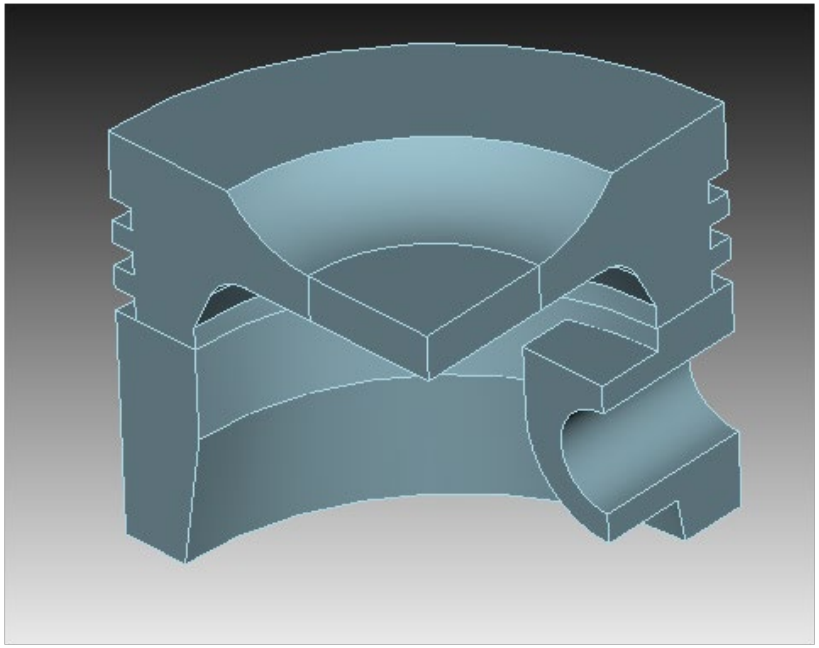
Manipulating Blocks

- Blocks can be manipulated from the tree
- Select “Blocks”
  - right click
  - Create new block
  - Drag and drop geometry into block
- Select created block
  - Draw
  - List
  - Delete
  - Tet specific options



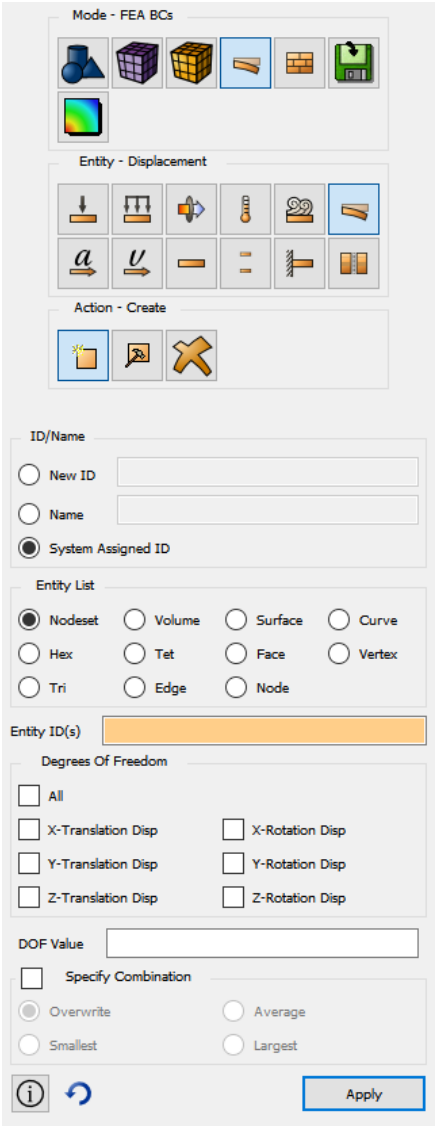
Exercise 1

1. Import quarter_piston.sat
2. Create material steel1040
   - E = 30.0e6
   - ν = 0.3
   - ρ = .284 lb / in^3
3. Create block 9 with all volumes
4. Assign material to the block
5. Use the tree to draw the block



Defining Boundary Conditions

- **Boundary conditions can be defined for Abaqus, I-DEAS, LS-Dyna and Fluent**
- **Boundary conditions can be assigned to either the mesh or the geometry.**
- **Assigning BC's to geometry allows the mesh to be refined or changed without having to modify the BC set.**



Manipulating Boundary Conditions

Simulation Modeling Sciences

Select Exodus Groups

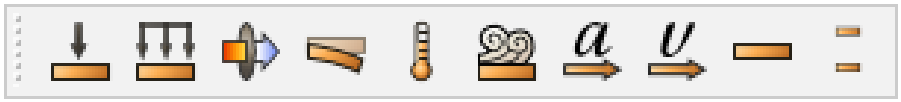


Toggle boundary condition display



Select FEA BC's

- Force
- Pressure
- Heatflux
- Displacement
- Temperature
- Convection
- Acceleration
- Velocity
- Contact Region
- Contact Pair



Select CFD BC's

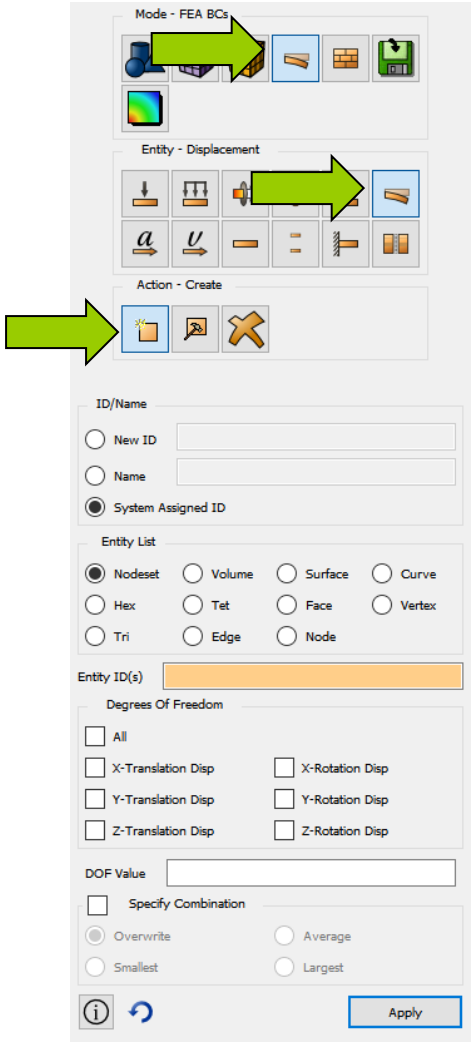
- Inlet mass flow
- Inlet pressure
- Inlet velocities
- More . . .



Define Displacement

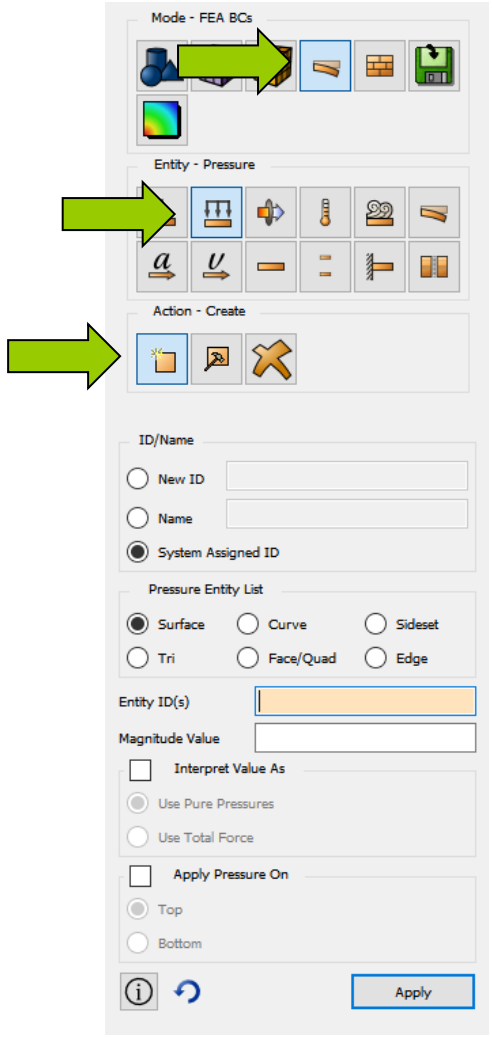
- User can define displacements with either an id or a name
- Displacements can be defined on geometry or mesh
- Specify both constraints and enforced displacements

- Boundary conditions specified on geometry persist across webcuts.



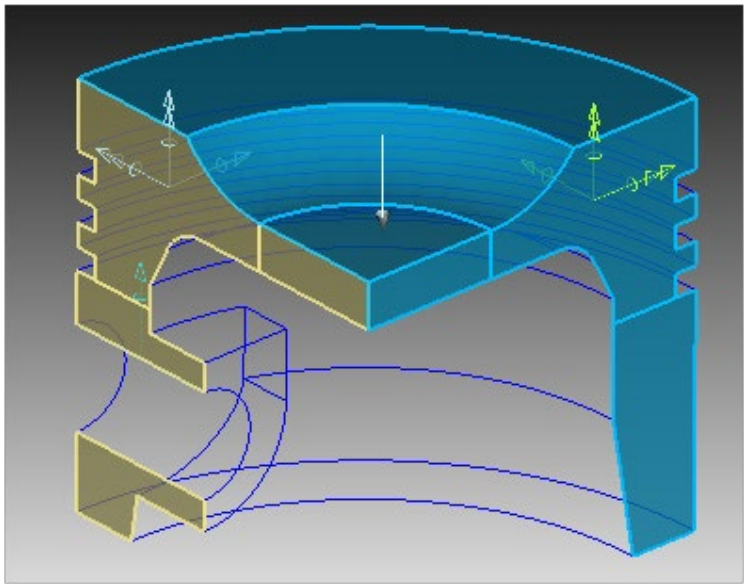
Define Pressure

- User can define pressures with either an id or a name
- Pressures can be defined on geometry or mesh
- Specify pressure value
- Specify shell side



Exercise 2

- Toggle on the BC display
- Create symmetry displacement constraints on the symmetry surfaces
  - Fix plane normal direction
  - Fix rotations across plane normal
- Fix curve on top of piston pin
- Create 1100 psi pressure on the top surfaces of the piston.

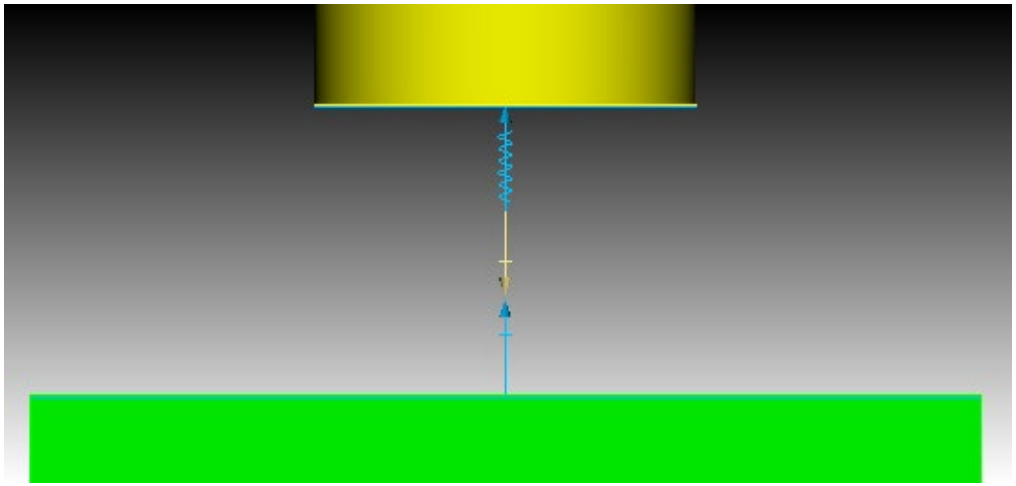


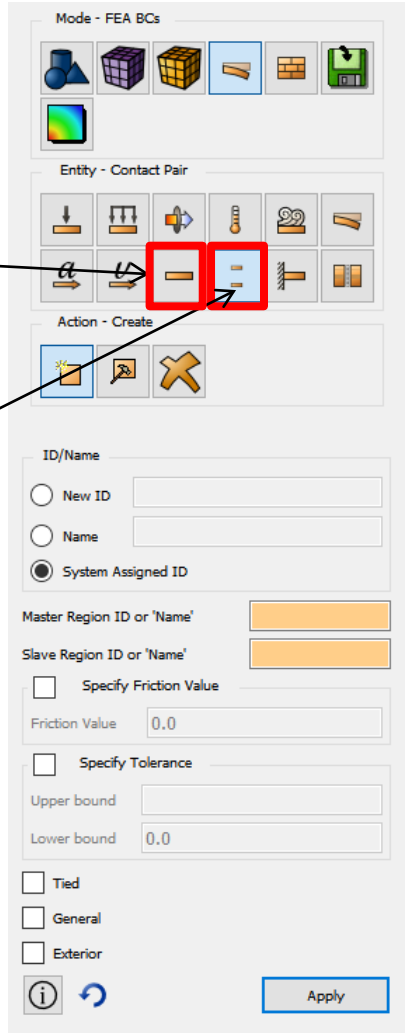
- Check that at least one constraint exists in every DOF.

Specifying Contact

Specifying contact requires two steps

- **Create contact regions**
  - **Areas where contact is defined**
- **Create contact pairs**
  - **Contact regions that interact**





Example 3

Play three_point_bending.jou (regularize vol all)
Define contact regions at the top and the bottom of the plate
Define a contact region at the tip of the punch
Define a contact region on the cylindrical support surfaces

Define a contact pair between the supports and the plate bottom
Define a contact pair between the punch and and the plate top

Fix the bottom of the supports in all 6 DOFs

Apply a velocity of .1 in/s to the tip of the punch

