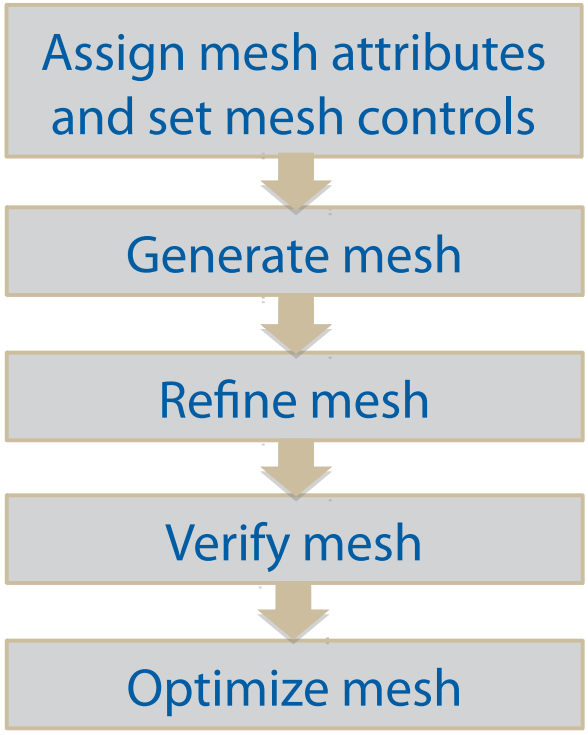
ABAQUS

ME 498CM Fall 2015

Meshing

ABAQUS Meshing

Meshing Workflow



OBJECTIVE—*balance results accuracy against rate of convergence*

CREATION—*seeding, element type, remeshing techniques*

VERIFICATION—*element quality, shape factor, aspect ratio, element degeneracy*

REMESHING/REFINEMENT—*based on results of analysis incl. large deformations or gradients*

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Dependent *v.* Independent

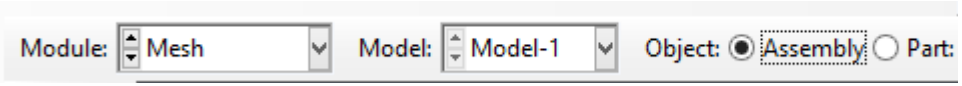
- **Dependent**

  Instance is a pointer to the meshed original part

- **Independent**

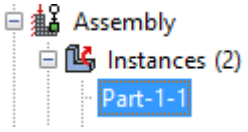
  An independent part instance is a copy of the geometry of the original part

No customization allowed: cannot modify geometry, partition, virtual topology



How to Switch:

1. In the context bar, change the Object
2. In the model tree, right click the instance name



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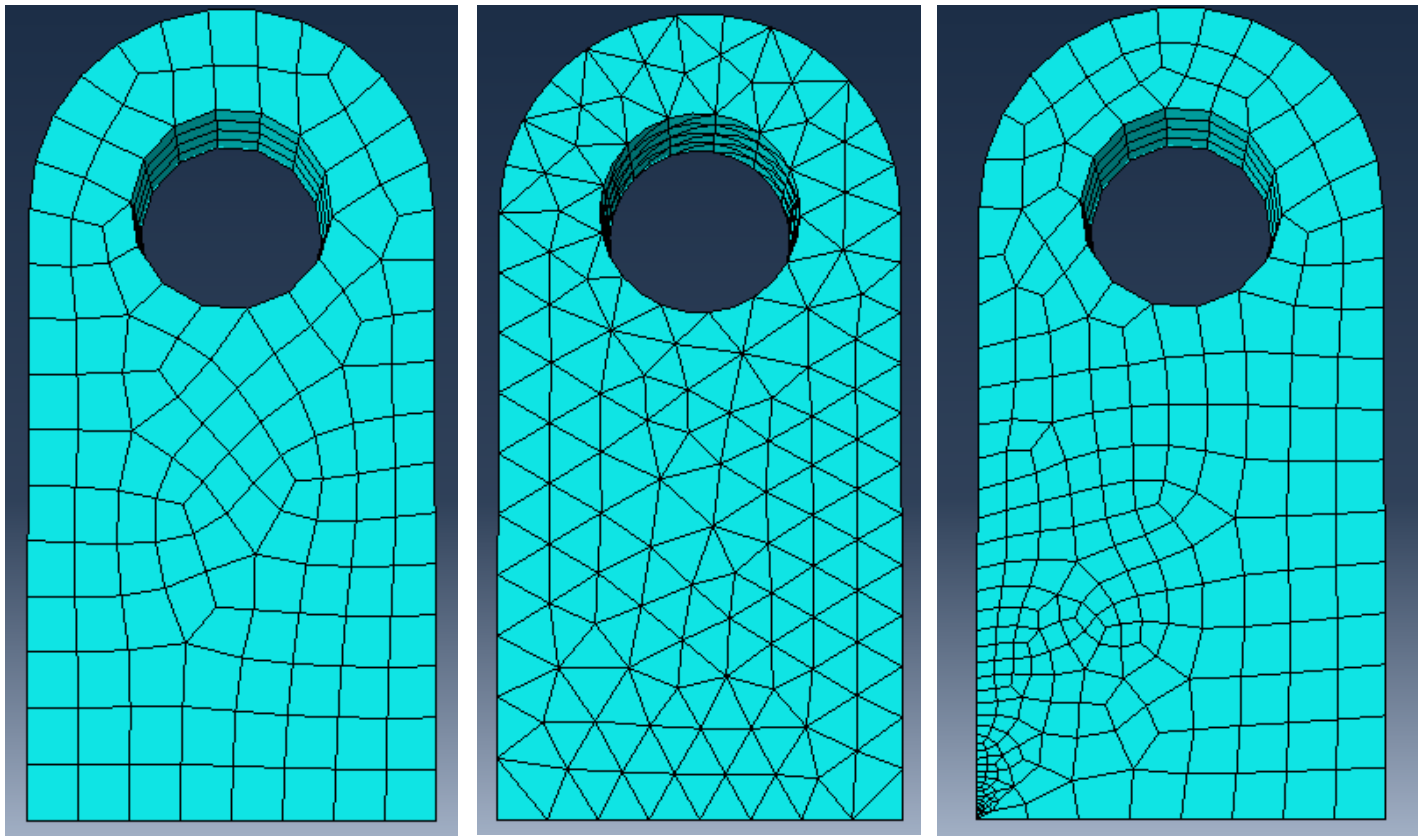
Mesh Attributes

- Element shape control
- Seed assignment and bias



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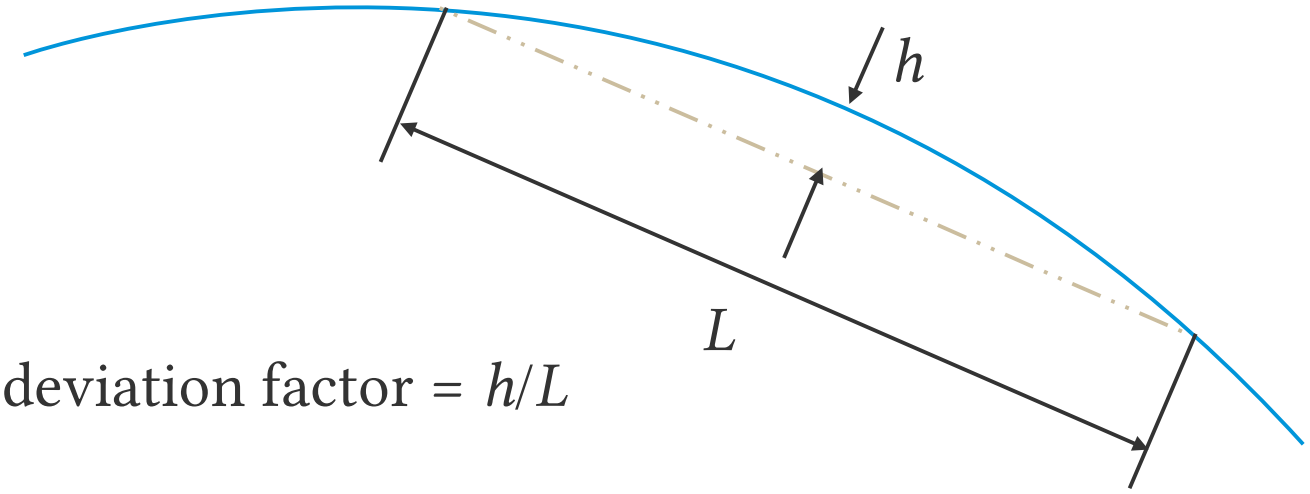
Mesh Attributes: Curvature Control

- Seed distribution based on edge curvature and target element size
- Accounts for deviation factor and minimum size factor



deviation factor = h/L

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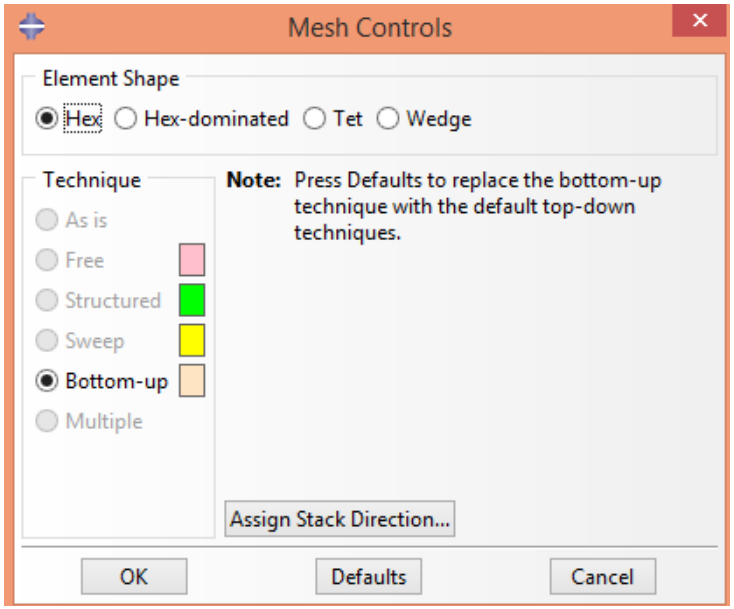
Meshing techniques

- **Top-down** meshing
  - **Structured** meshing
  - **Swept** meshing
  - **Free** meshing
- **Unmeshable** part
  - **Bottom-up** meshing



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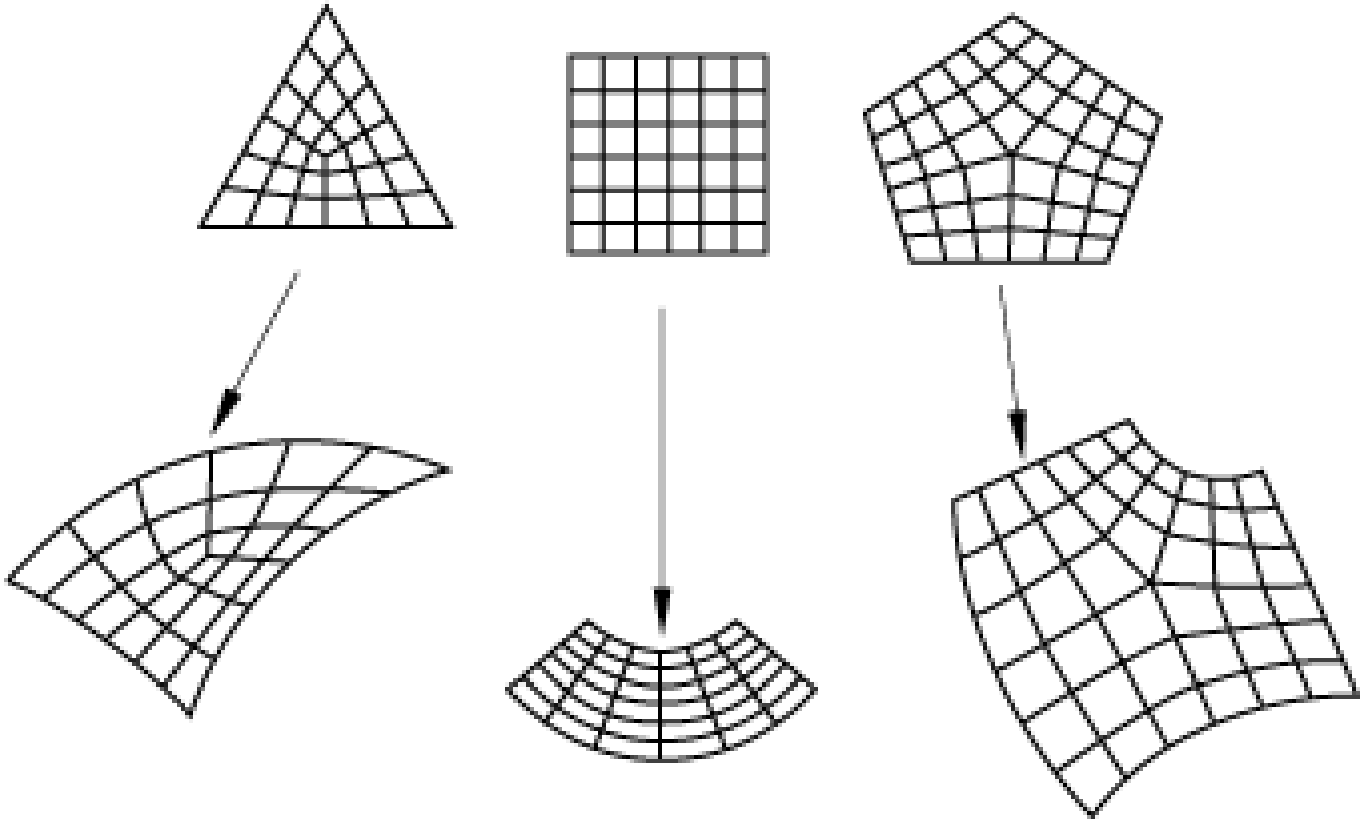
Structured Meshing



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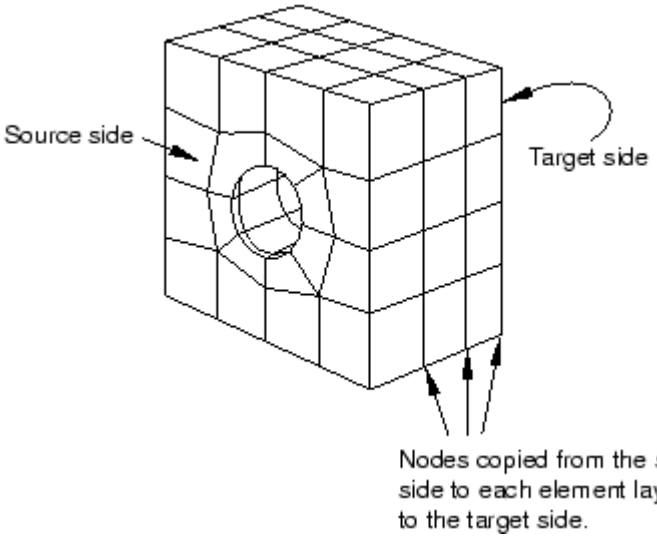
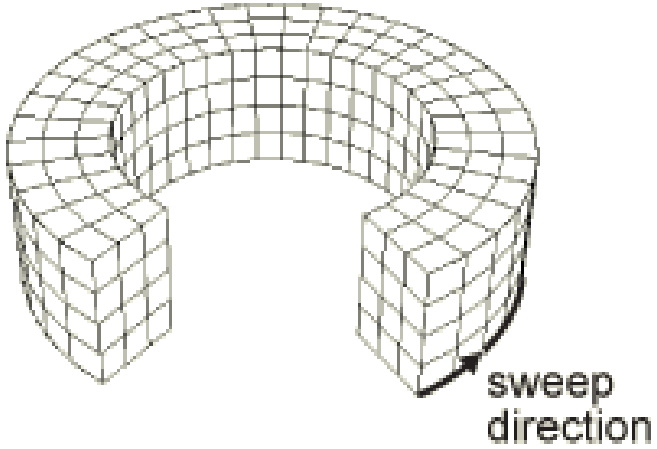
Swept Mesh





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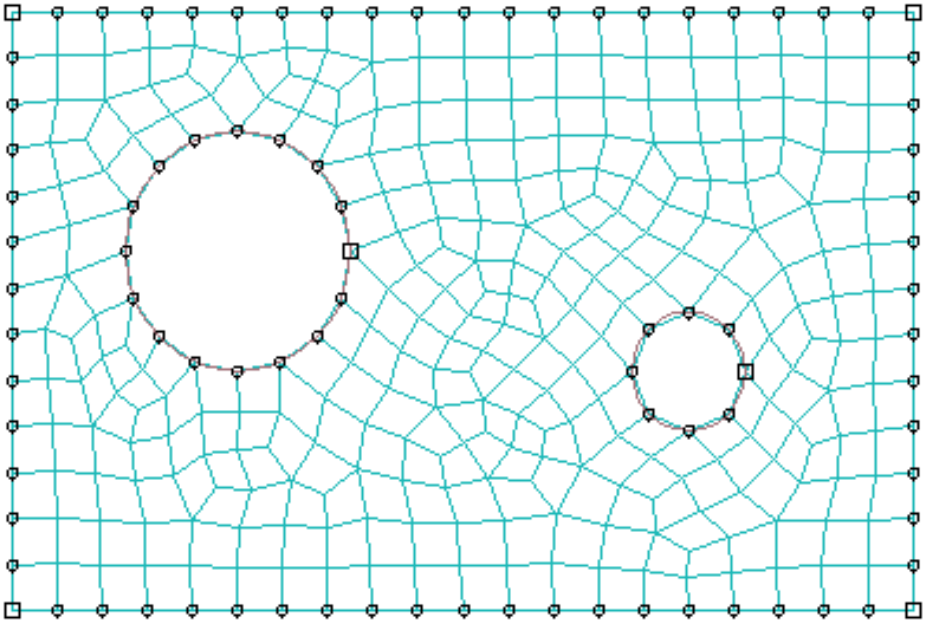
Free Meshing



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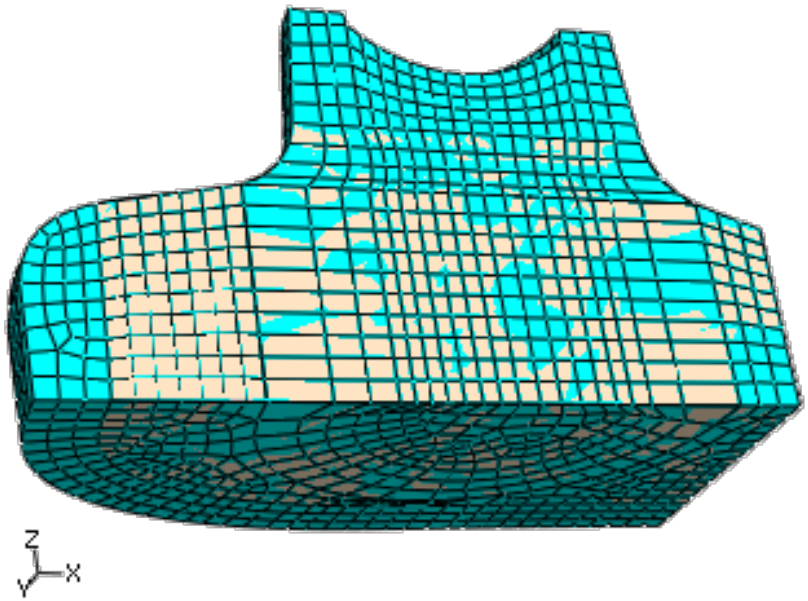
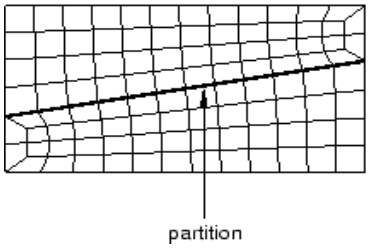
Bottom-Up Meshing

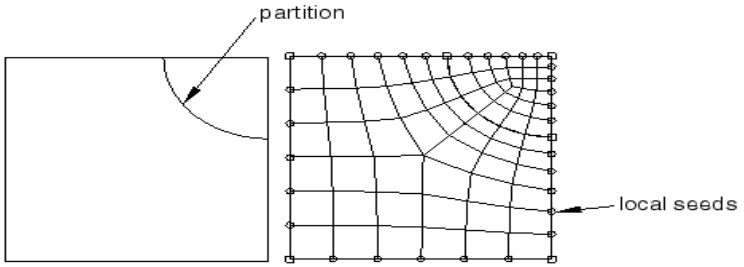


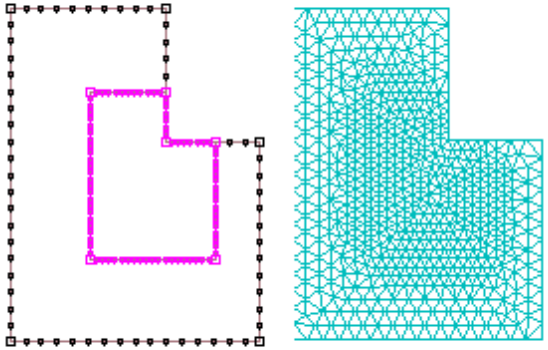
Example 17.11.10

ABAQUS Meshing

Refinement by Partitioning







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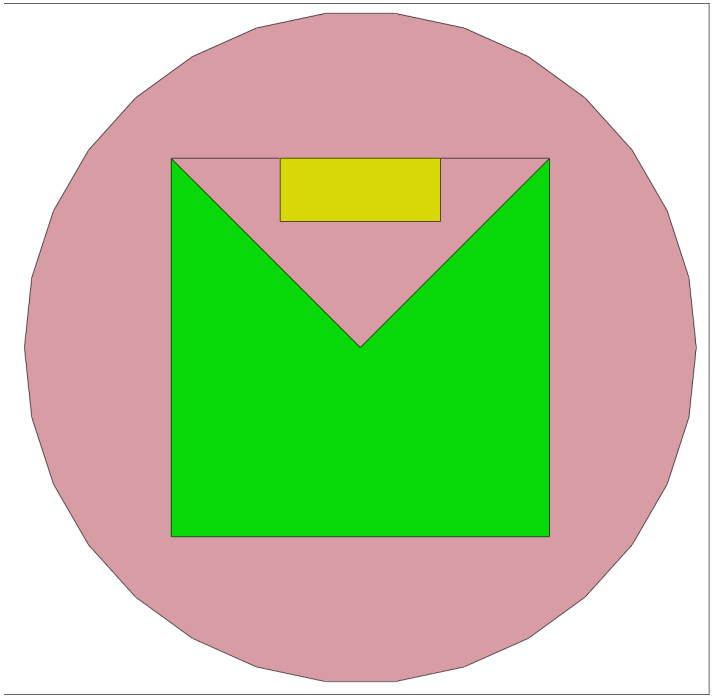
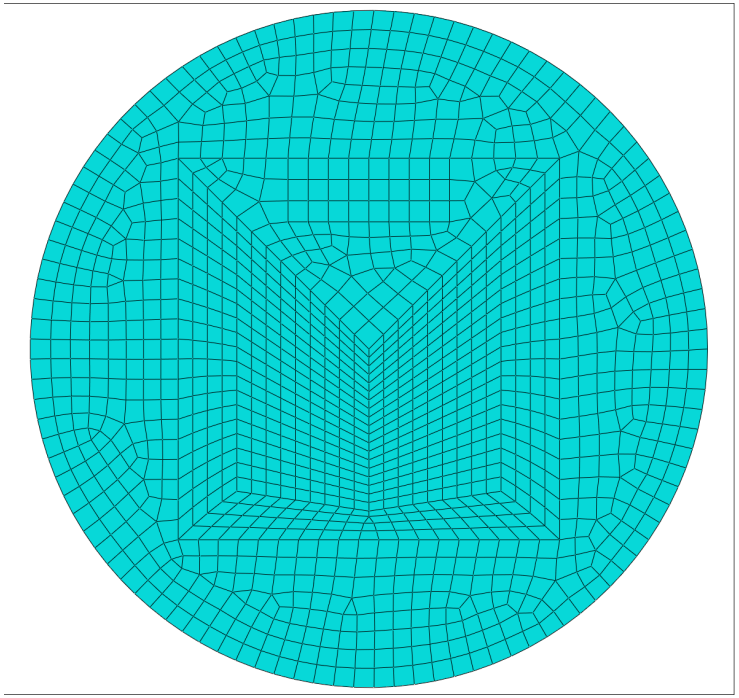
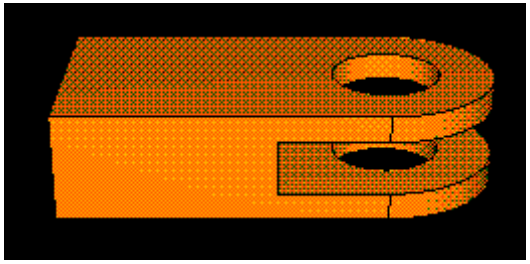
Refinement by Partitioning

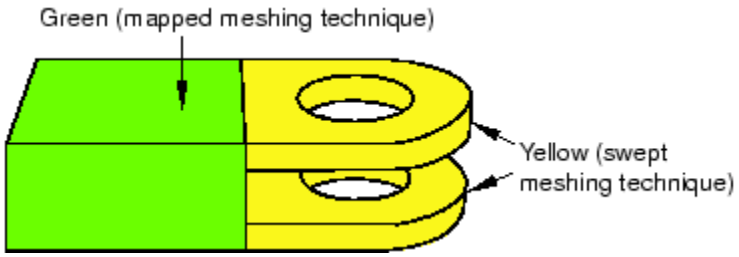


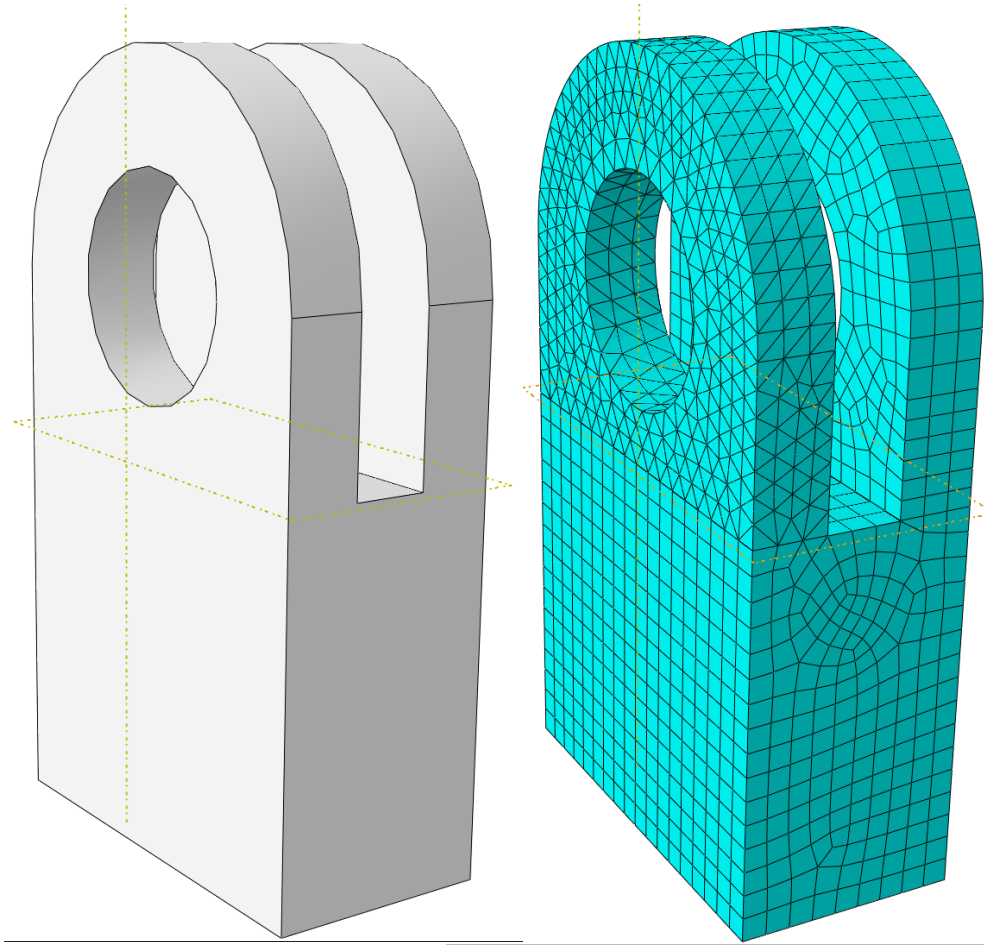


ABAQUS meshing

Refinement by Partition







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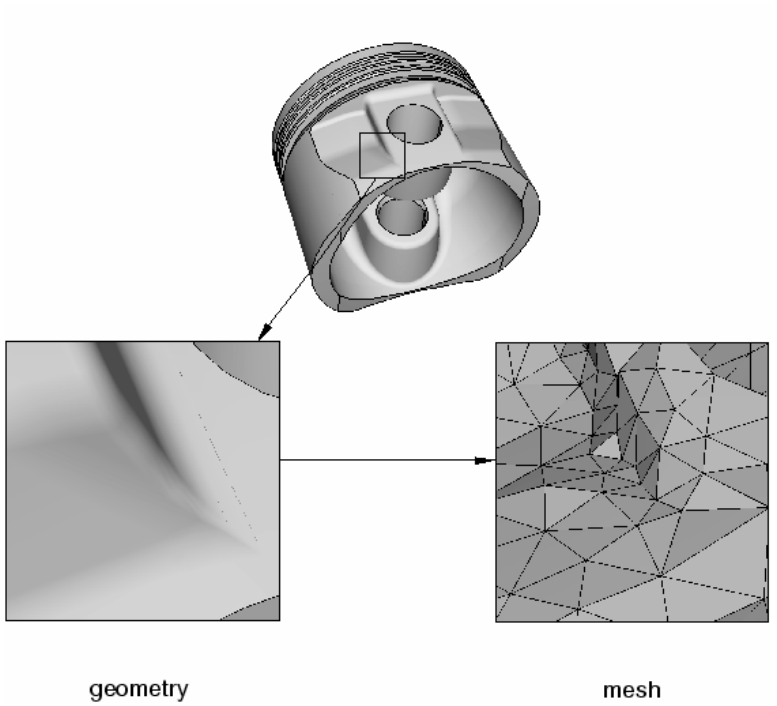
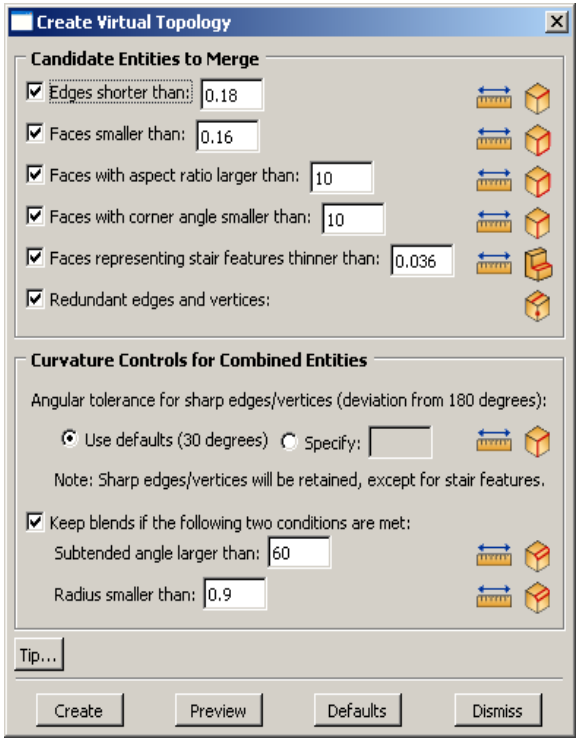
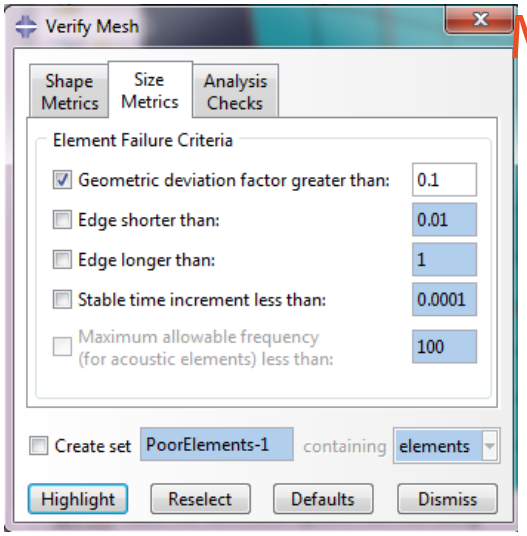
Refinement by virtual topology





ABAQUS meshing

Mesh Verification



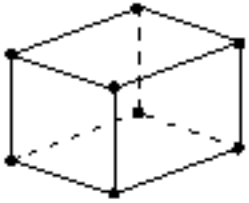
Shape Factor:
triangular and tetrahedral elements

Aspect Ratio:
Ratio between longest and shortest edge of a element.

Selection criterion	Quadrilateral	Triangle	Hexahedra	Tetrahedra	Wedge
Shape factor	N/A	0.01	N/A	0.0001	N/A
Smaller face corner angle	10	5	10	5	10
Larger face corner angle	160	170	160	170	160
Aspect ratio	10	10	10	10	10

ABAQUS Elements

Element Library



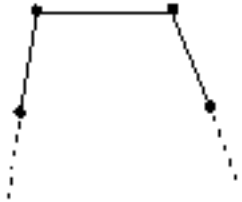
Continuum
(solid) elements

Shell
elements

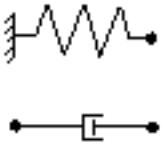
Beam
elements

Rigid
elements

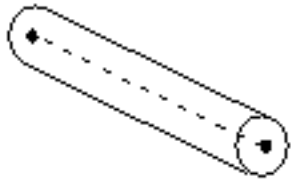
Membrane
elements



Infinite
elements



Springs and dashpots



Truss
elements

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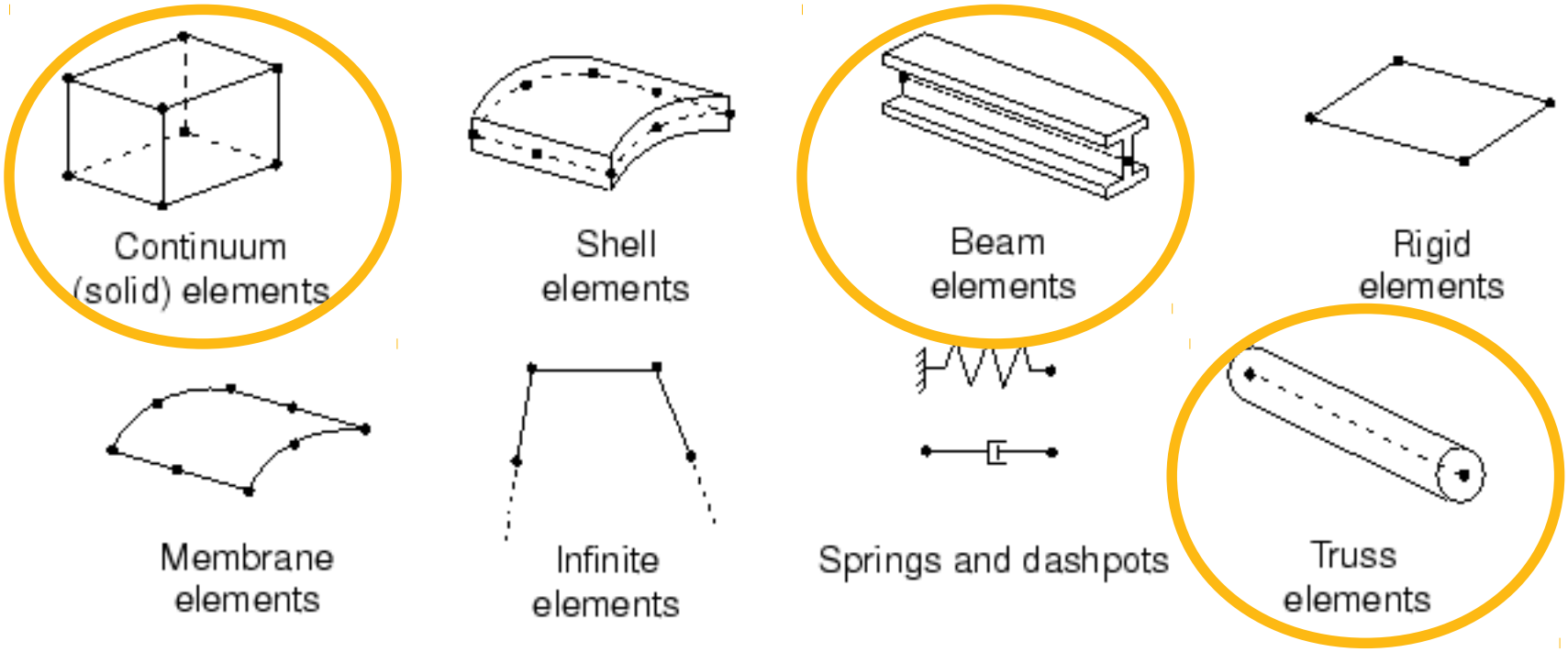
Element Library



+ gap/contact elements, etc.

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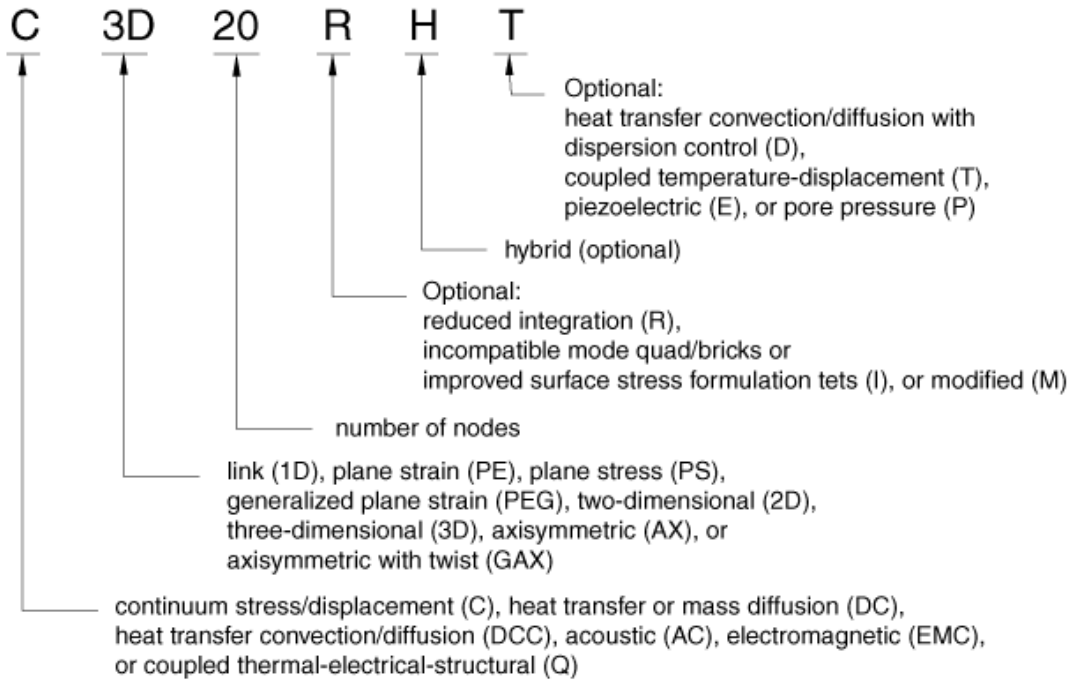
Element Naming Convention



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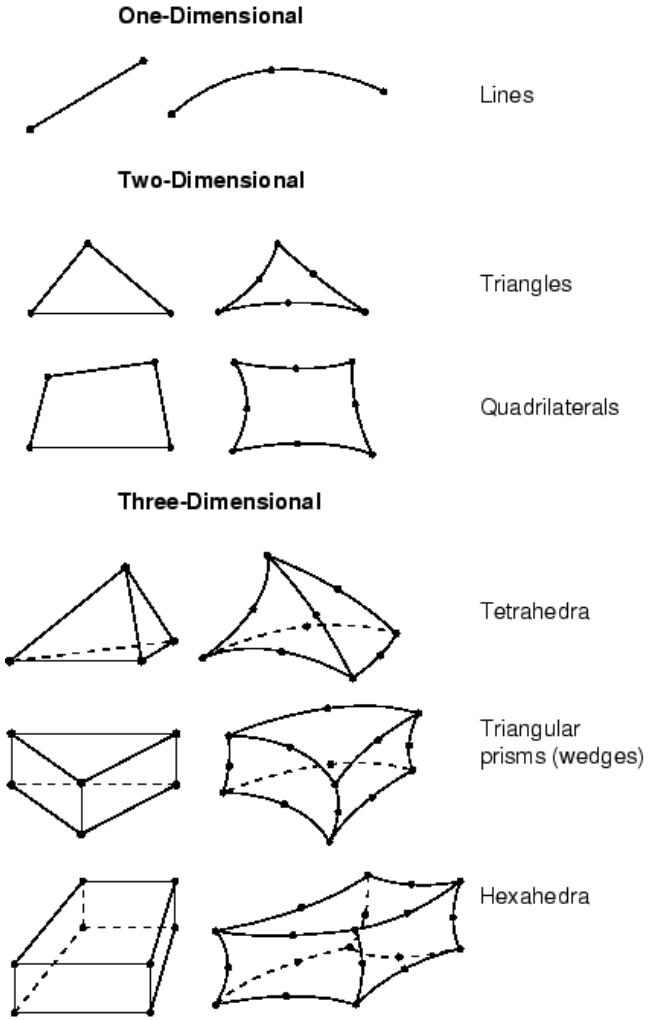
Element Selection & Properties



Topologically,
CPE4 = CAX4R = S4R = DC2D4 = AC2D4

no checking of DOFs in CAE

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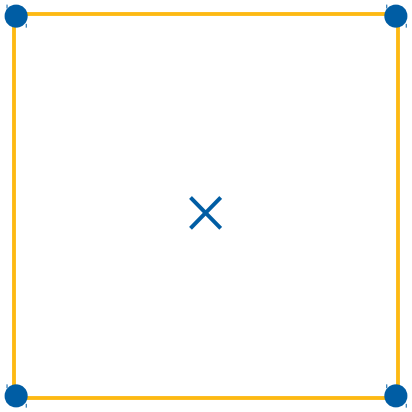
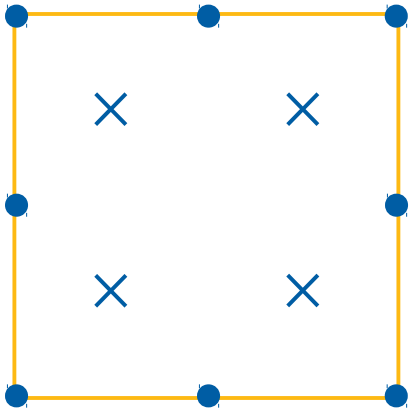
Reduced Integration



linear
(CPS4R etc.)



quadratic
(CPS8R etc.)

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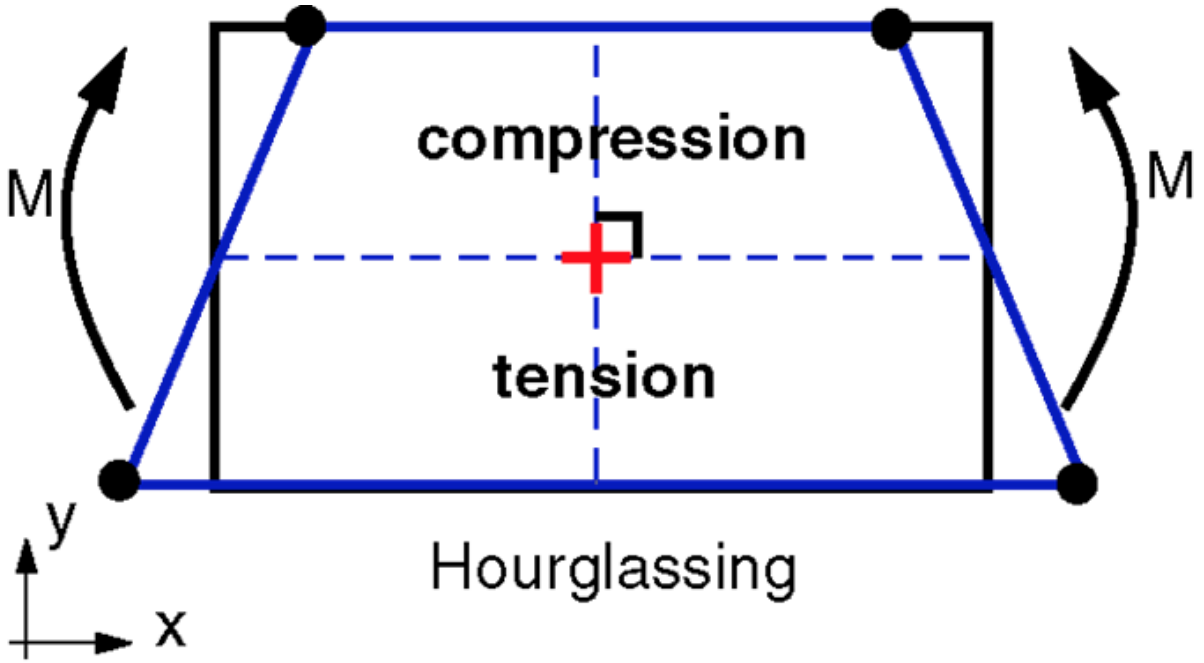
Hourglassing



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Shear Locking